FIRST GARDEN OF THE REPUBLIC

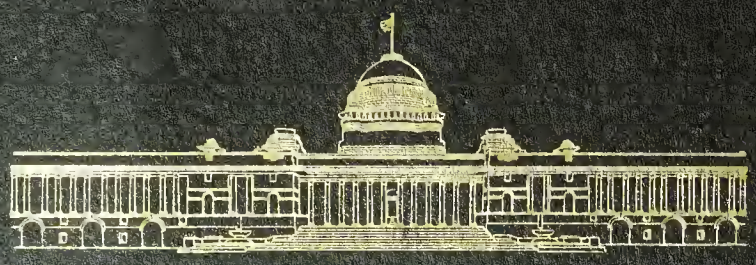


NATURE IN THE PRESIDENT'S ESTATE

Renowned across the world, the Mughal Garden of the Rashtrapati Bhavan in Delhi attracts millions of visitors. Less well known is the fact that the President's Estate also contains hundreds of acres of jungle, orchards, cultivated fields and open grounds, all teeming with a wealth of plant and animal life that did not exist 85 years ago. How was this miracle achieved? What keeps it going today?

This book is a comprehensive survey of nature on the President's Estate. It shows how, in the last days of empire, the British transformed the once-barren hilltop of Raisina into a lush landscape designed to display colonial power and style. After Independence, this imperial legacy was reshaped to serve the public purpose. As a result, an oasis of ecological diversity flourishes in the heart of urban Delhi.

First Garden of the Republic documents the flora and fauna of the Estate across the seasons. It shows how human agency creates and curates this habitat, looking particularly at the quiet yet constant work done by the malis (gardeners). It traces the history of the formal gardens and forests, highlighting the role of sentiment, status and taste in designing the landscape. Cultural designs and intents are, however, made and unmade by the dynamics of nature. This book explores how plants and animals make the President's Estate their own, adapting it to their ends, and the challenges these living creatures and their habitats face today. This book is part of a series of volumes documenting different aspects of the rich cultural, social and historical legacy of the Rashtrapati Bhavan as a national institution.



RASHTRAPATI BHAVAN, NEW DELHI



Digitized by the Internet Archive
in 2018 with funding from
Public.Resource.Org

https://archive.org/details/firstgardenofrep00

FIRST GARDEN OF THE REPUBLIC



FIRST GARDEN OF THE REPUBLIC

NATURE IN THE PRESIDENT'S ESTATE

Edited by

AMITA BAVISKAR

Photography by

NARENDRA BISHT

Published by

PUBLICATIONS DIVISION, GOVERNMENT OF INDIA

FIRST GARDEN OF THE REPUBLIC:
NATURE IN THE PRESIDENT'S ESTATE

© 2016 Rashtrapati Bhavan, New Delhi, India

Commissioned by President's Secretariat, Rashtrapati Bhavan, and Indira Gandhi National Centre for the Arts (IGNCA), Ministry of Culture, Government of India

Executed by Sahapedia

Edited by Amita Baviskar

Photography by Narendra Bisht

Other photo credits:
British Library; Centre for South Asian Studies (CSAS), Cambridge University; Dinodia Photo; fotoLibra; Publications Division, Government of India; Rashtrapati Bhavan Archives; Royal Institute of British Architects (RIBA); The Alkazi Collection of Photography; The Lutyens Trust; Wikimedia Commons; Sharyn Arthur; Amita Baviskar; Garima Bhatia; Samuel Bourne; Gavin Chapell; Brinda Datta; Suniti B. Datta; Arthur Gill; Bikram Grewal; Vaidehi Gunjal; Munish Gupta; E.E. Hall; Dinesh Khanna; Malavika Karlekar; Ashish Kothari; Pradip Krishen; Ranjit Lal; Gururaj Moorching; Dhruv Pal; Vishal Prasad; T.K. Sajeev; Supriyo Samatha; Sumit Sen; Ghazala Shahabuddin; Marjorie Cartwright Shoosmith; Ramki Sreenivasan; Nitin Srinivasamurthy; Anjali Verma; Vishal Vishwakarma

Every effort has been made to obtain permission to use the images published in this book and/or acknowledge the copyright holders. In case there is any objection pertaining to copyright or if any copyright holder has not been acknowledged inadvertently, the publishers encourage that such cases may be brought to their notice and the same will be rectified appropriately in future editions.

Note: For reasons beyond our control, some of the photographs of birds have been taken outside the President's Estate. All the birds shown in this book are, however, found on the Estate.

Map credits: *LA: Journal of Landscape Architecture;* Akanksha Thapa

Researchers: Ektaa Jain, Dhruv Pal, Akanksha Thapa, Anjali Verma

Editorial Consultant: Nirmal K. Bhattacharjee

Copy Editor: Aruna Ghose

Designed by Brinda Datta

Production Coordination: V.K. Meena, Publications Division

Printed at Nutech Print Services

Note: Opinions expressed by the authors are theirs alone, and do not necessarily reflect the opinions of the Rashtrapati Bhavan or any employee thereof.

All rights reserved.
No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, without permission in writing from the President's Secretariat and the Publications Division.

Price: ₹ 1940

PD BN

ISBN 978-81-230-2129-4

RB-ENG-OP-011-2016-17

Published by Additional Director General
Publications Division
Ministry of Information and Broadcasting,
Government of India



Photo credit: Brinda Datta



NOTE ON NOMENCLATURE

PLANTS AND ANIMALS have precise scientific names but these complex compounds of Latin and Greek can be hard to decipher and remember. So we have used common names throughout this book, with the scientific names listed in the appendices.

However, using common names raises a new set of questions: Which one should we use? Laurel fig or usba? How should we spell them? Vilaiti keekar or vilayti kikar? Should we italicise non-English words? Khirni or *khirni*? The usual practice is to capitalise the common names of animals but to use lower case for the common names of plants. Would it not be awkward if we were to write: A Purple Sunbird sips from the flower of the chestnutleaf trumpet-bush? Questions such as these keep fastidious editors awake at night!

In this book, the names and spellings of trees adopt the usage in Pradip Krishen's *Trees of Delhi*. Another standard guide, Richard Grimmett, Carol Inskipp and Tim Inskipp's *Pocket Guide to the Birds of the Indian Subcontinent*, has been used for bird names. Plant names are in lower case while animal names are capitalised. Italics have not been used except for the occasional scientific name that occurs in the text (usually because the plant or animal in question does not have a common name).

CONTENTS

FOREWORD
Honourable President Pranab Mukherjee
8

PREFACE
Omita Paul
11

CHAPTER ONE
Introduction: First Garden of the Republic
Amita Baviskar
12

CHAPTER TWO
The Formal Gardens: English Flowers in an Islamic Charbagh
Amita Baviskar
30

CHAPTER THREE
Avenue and Forest Trees: Unravelling the Planting Scheme
Pradip Krishen
66

CHAPTER FOUR
Backstage: Gardeners at Work
Amita Baviskar
108

CHAPTER FIVE
Wildlife: Creatures Great and Small
Ghazala Shahabuddin
126

CHAPTER SIX
Birds: Heirs of the Ecological Mosaic
Ghazala Shahabuddin and Amita Baviskar
160

CHAPTER SEVEN
Seasons: The Cycles of Life
Ghazala Shahabuddin
198

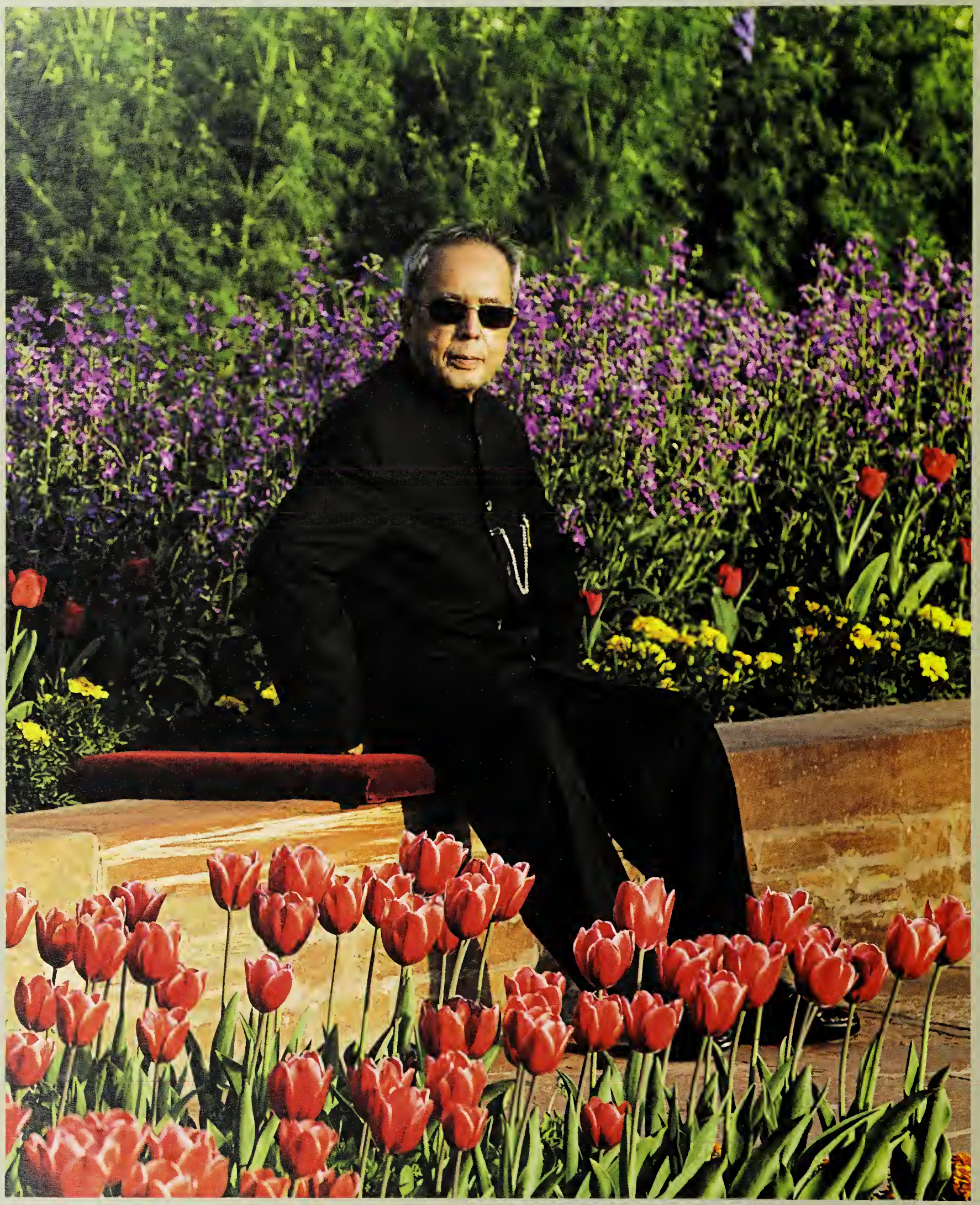
NOTES
235

APPENDICES
240

ACKNOWLEDGEMENTS
249

BIBLIOGRAPHY
250

INDEX
252



सत्यमेव जयते

PRESIDENT
REPUBLIC OF INDIA

FOREWORD

The gardens of the Rashtrapati Bhavan are renowned across the world and attract millions of visitors. Once a secluded oasis for the private enjoyment of the viceroy, they now embody the spirit of democratic openness and intermingling. The title of this volume, *First Garden of the Republic: Nature on the President's Estate*, captures this sensibility and its significance.

It has been a delight for me to walk in the Mughal Garden every morning and start the day in the company of bird calls, fragrant blooms and serene natural beauty. Yet the President's Estate also harbours a wealth of plants and animals that is not widely known and appreciated. Forests, orchards, vegetable gardens and avenues on the Estate together create an ecological mosaic that teems with biodiversity. Conserving this wealth is crucial for the Estate and for the city of Delhi. I am happy to note that, over the years, the Estate has emerged as a role model for sustainable management of water and organic waste.

This book, as part of the multi-volume documentation of the Rashtrapati Bhavan, surveys the flora and fauna of the President's Estate. It shows how the once-barren hilltop of Raisina was transformed into a lush landscape designed to display colonial power, only to be reoriented after Independence to represent the ideals of a democratic nation. The book pays homage to the gardeners of the Estate in bringing about this transformation. It is their ceaseless toil in every season that makes the Estate a place of beauty, the pride of India.

I salute the gardeners of the Rashtrapati Bhavan who work quietly behind the scenes to create a glorious garden for the world to enjoy. I wish them well in their endeavours. I also wish the volume and series well.

PRANAB MUKHERJEE
PRESIDENT OF INDIA
JULY 2016
RASHTRAPATI BHAVAN, NEW DELHI



PREFACE

The present volume on the flora and fauna of the President's Estate is part of a multi-volume documentation project that seeks to capture and present various facets of life at the Rashtrapati Bhavan. Although stand-alone volumes on the Rashtrapati Bhavan have been published in the past, in-depth studies on different aspects of this living heritage are conspicuous by their absence. A need was therefore felt for researching and documenting the various inter-related aspects of the Rashtrapati Bhavan into a seamlessly interwoven series of books for posterity. With this objective in mind, the President's Secretariat commissioned a documentation project to present a multi-volume series in collaboration with the Indira Gandhi National Centre for the Arts and Sahapedia.

It is impossible to overemphasise the historical, political, architectural and ecological significance of the Rashtrapati Bhavan. The erstwhile Viceroy's House, which was initially intended to be the showpiece of British colonial power, has undergone a radical transformation and, after Independence, represents the epicentre of the world's most populous and vibrant democracy. The official residence and office of the head of the state of India is also a meeting ground for world leaders, heads of states and other dignitaries. The architectural form of the Rashtrapati Bhavan blends western and eastern styles, as also tradition and modernity. The syncretic form of the Rashtrapati Bhavan is reflective of the very idea of India.

This volume on the flora and fauna of the Rashtrapati Bhavan, titled *First Garden of the Republic: Nature on the President's Estate*, is the sixth in the multi-volume series. Whereas previous books have confined themselves to describing the world-famous Mughal Garden, this volume is notable for original research that documents the cultivated as well as the wild parts of the Estate and shows how the Estate as a whole is a haven for plant and animal diversity. After Independence, the gardens and grounds of the President's Estate have been transformed to provide more access to the public. More recently, they have taken on a new role as a model for sustainable resource use. I am certain that this volume will capture for readers the natural beauty, ecological wealth and wisdom to be found on the President's Estate.

I am also confident that as these volumes unfold over the course of the next year, they will substantially enrich our understanding of the Rashtrapati Bhavan and its centrality to the idea of a progressive, dynamic and visionary Indian state.

OMITA PAUL
SECRETARY TO THE PRESIDENT
JULY 2016
RASHTRAPATI BHAVAN, NEW DELHI

chapter one

Introduction

FIRST GARDEN OF THE REPUBLIC

AMITA BAVISKAR

A hundred years ago, what is now the President's Estate was a sun-blasted, boulder-strewn saddleback, one among several hills in the northernmost spur of the Aravalli range. But for its sweeping prospect, there was little to suggest that this nondescript site was suitable as a seat of imperial power. As Lord Hardinge, then viceroy of India, recounted in his memoirs, in November 1912, he rode up the slope of Raisina Hill with the Chief Commissioner of Delhi, Malcolm Hailey.

> From the top of the hill there was a magnificent view embracing old Delhi and all of the principal monuments situated outside the town, with the River Jumma (*sic*) winding its way like a silver streak in the foreground at a little distance. I said at once to Hailey, 'This is the site for Government House', and he readily agreed.[1]

Hardinge's enthusiasm for the panoramic vista visible from Raisina Hill came to be supported by more weighty reasons. The previous December, the King-Emperor George V and Queen Mary had laid the foundation stone of the future capital of British India at a spot north of the walled city of Shahjahanabad, a low-lying area close to the river. There were thus two chief contenders for the location of the new city: this northern site and the southern expanse topped by Raisina Hill. Through the summer of 1912, the Delhi Town Planning Committee, appointed to advise the viceroy on site selection, surveyed the rugged country around Delhi and decided that the site south of Delhi was superior in all respects. Edwin Lutyens, a member of the committee who would later plan all of New Delhi and design Government House, wrote to his wife that 'aspect, altitude, water, health, virgin soil' all favoured the southern site, as did the 'views across old Delhi to that wilderness of ruined tombs that form the remains of the 7 older Delhis'.[2] The southern site was healthier because it had better drainage; it was cheaper because land would have to be acquired only from the few villages that dotted the area; and it had ample room to accommodate an expansive style of life. This last point was important. The northern site offered only cramped possibilities since the best land was already built upon with Civil Lines and military establishments. The southern site, however, was a blank canvas, calling for a breadth of vision fitting for a truly imperial city. Situated here, the centre of government for the entire subcontinent could successfully 'convey the idea of peaceful domination and dignified rule over the traditions and life of India by the British Raj'.[3] Thus, ecology, economics and imperial iconography were key concerns in choosing a place for New Delhi, just as they were for planning what is now the President's Estate.





PREVIOUS PAGE:
From the Rashtrapati Bhavan looking down at the Forecourt with the Jaipur Column flanked by laurel fig trees and the North and South Blocks beyond

Government House, later called Viceroy's House, was meant to be the crowning glory of the new capital of British India. Hardinge wanted it to be right on top of 'the Ridge above Talkatora' and wrote to Lutyens in August 1912, 'Can you imagine how splendid a white Government House with red tiles and a gilt dome would look in such a commanding situation, dominating the whole of the country round, while the slope down to the plain would be covered with terraces and fountains like a miniature Versailles?'[4]

Imagining such a sight was hard. The Ridge or *pahaadi* as it was locally known, consisted of quartzite rock, 'generally bare [and] supporting little or no vegetation save a stunted Kikar (*Acacia arabica*) or Kareel (*Capparis aphylla*) or the small bush of the Ber (*Zizyphus nummularia*) ... A moderate pasture is obtained by flocks of sheep and goats herded by Gujar boys.'[5] The hill that engaged Hardinge's fancy was part of the commons of Raisina village. Long years of providing fodder and fuel had so denuded the area that, 'except for a stray Kikar or Karil (*sic*) there was nothing that had not been cut or browsed down to a few inches'.[6] The area was fenced and closed to grazing in 1913 but to little effect. Matters improved once the lands of Raisina village were acquired and its inhabitants relocated,[7] and more decisively once afforestation was taken up in earnest.

To answer critics who thought the site too barren, Hardinge brought in P.H. Clutterbuck, Conservator of Forests in the United Provinces, 'the most capable forest officer [he] could find', to see if the Ridge could be greened.[8] Clutterbuck identified a number of indigenous trees from the drier parts of the Himalayan foothills and planting began in 1917–18, slowly and on a scale limited by wartime budget constraints.[9] The results were disappointing. Trees died off as soon as watering was stopped; few species could withstand the rigours of Ridge conditions, its thin soils and exposure to extreme summer and winter temperatures.[10] Over the next 20 years, the government struggled with this uphill task. Though some native trees such as ronjh, dhak and siris managed to survive, it was the Central American Mesquite (*Prosopis juliflora* or vilaiti keekar) that proved to be the most tenacious. As the Annual Report for



Government Gardens 1935–36 noted, '*Prosopis juliflora*, one of the hardiest of drought resisting trees, forms the main base of useful, evergreen vegetation; and trees raised from seed a few years ago are now well developed and gradually extending in to fresh ground'. This exotic had a major champion in William Mustoe, who was appointed Delhi's Superintendent of Horticultural Operations in 1919 and also given the charge of Forest Officer for the Ridge. Lutyens's assistant, Walter George, remembered accompanying Mustoe in his old car on Sundays with a few men with crowbars and pickaxes. Mustoe would walk over an area and then say 'Loosen that crack a bit for me' or 'Dig a little here' and then he would put in his seeds.[11] Mustoe's diligence and vilaiti keekar's persistence left a lasting legacy. The 'useful evergreen' tree became an invasive species, crowding out the natives. Vilaiti keekar now rules the Ridge, as it does across much of the subcontinent's drylands.

Vilaiti keekar's monopoly on the Ridge was not absolute however. Some of the natural vegetation managed to spring back to life once protected. Patches of dhau, the slender tree that once dominated sections of the Aravallis, grew back from ancient roots long established in the soil, as did the hardy kareel, barna, bilangada, karaunda, hingot, chamrod and dhak. By the winter of 1918, in places these trees and shrubs formed 'thickets it would be difficult to get through'.[12] The forested Ridge, as we now know it, was thus the result of years of labour — not only guarding the area but also growing seedlings, digging pits, planting and watering, and starting from scratch once again when young saplings were killed by drought or frost. That this labour seems invisible today is a tribute to the regenerative resilience of plants as well as the dedication of those who planted and protected them. It is thus ironic that commentators contrast 'the untamed Delhi Ridge' with the formal Viceroy's House and its 'geometric garden', as a statement about 'the passionate British resolve to bring order to India'.[13] They do not realise that the unruly Ridge and the ordered garden were both created and by the same people. Wilderness was cultivated as much as the rest of the landscape. This collusion of nature and culture that is the Ridge vegetation survives on the President's Estate today on two tongues of land that

LEFT PAGE:
The jungle on the President's Estate

ABOVE:
The Mughal Garden. Both the forest and the formal garden were planted by the colonial government





ABOVE:
By 1927, the formal gardens had been laid out even as construction continued on the dome of the Viceroy's House
[Source: British Library]

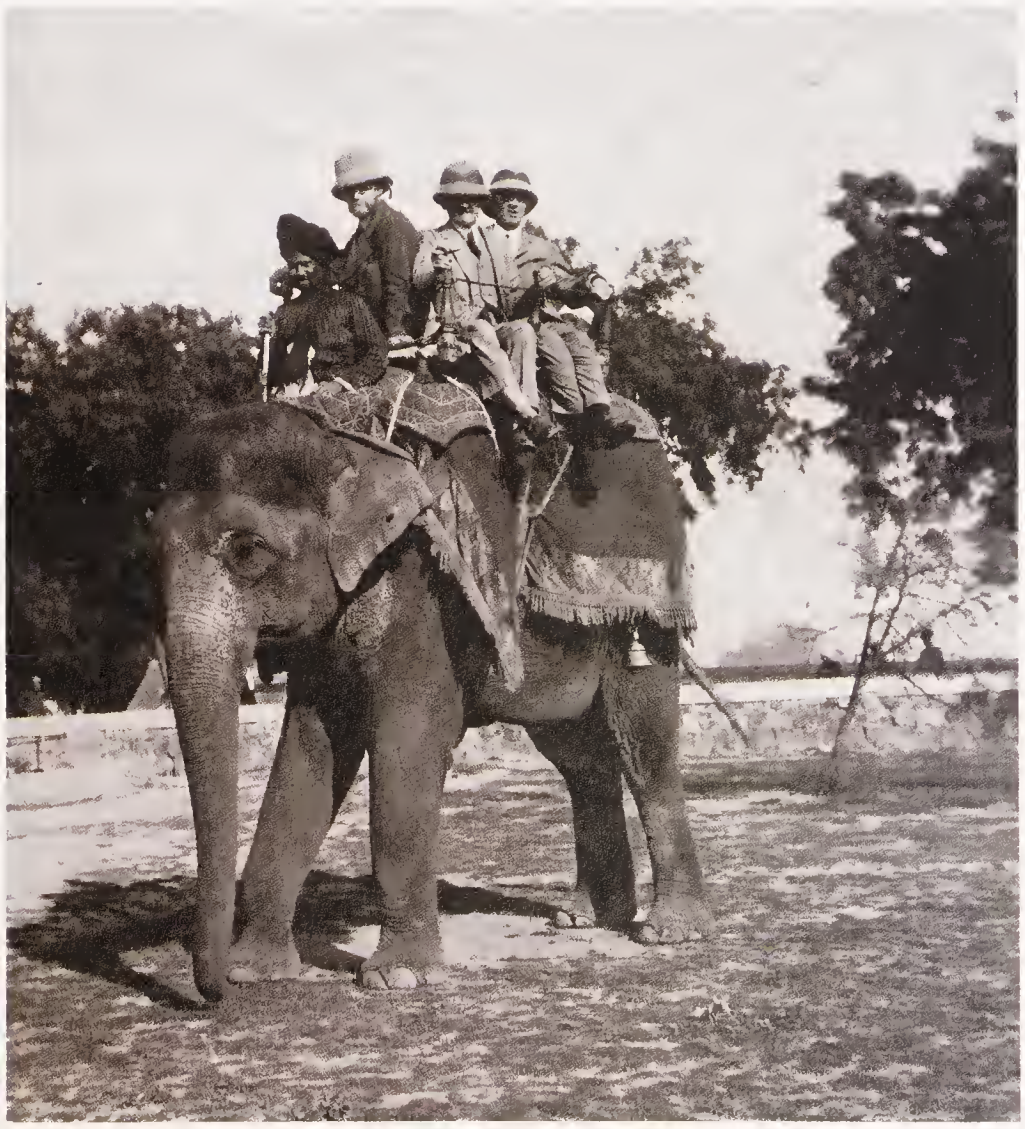
RIGHT:
In the early 1920s, the top of Raisina Hill was blasted away and a railway line laid to remove rocks and earth and carry sandstone and other materials to the flattened site
[Source: British Library]

wrap around the kitchen gardens of the Dalikhana. With more access to moisture, these patches are even more dense and wild looking than the area outside the Estate.[14]

As it happened, Hardinge's idea of building Government House on top of the Ridge was soon rejected.[15] The site chosen instead was the brow of Raisina Hill. To make it larger, less steep and more level, 20 feet of hard rock were blasted from the summit. Water was pumped from the Jamuna and piped up to the Ridge into filter tanks to supply the new city. A separate reservoir was built for unfiltered water to irrigate the Viceregal Estate.[16] Such strenuous efforts to move water and land indicate the importance of Government House as an icon of imperial prestige. What made it even more telling of power and privilege was its sheer excess. A 330-acre Estate with a house that covered five acres, 15 acres of ornamental gardens with lush greenery and lavish water fountains: in a country where most people worked their tiny fields to the utmost to coax out a living, a pleasure garden was the ultimate form of conspicuous consumption. Such profligacy, and at such spectacular scale, proclaimed the pre-eminence of British Raj over its dominion and subjects.

Although conceived as early as 1913, designs and budgets for buildings and gardens in the Viceroy's Estate kept changing for more than a decade.[17] Work on the house began in 1921. Edwin Lutyens had finalised the design of the formal gardens in 1917, but was able to implement it only in 1926. 'During that year, Lutyens took advantage of a lull in the building operations on the house to advance construction of the garden, the contractors' teams of hundreds of men being pressed into service'.[18] The planting of the gardens was largely done in 1928–29, two years before the viceroy, Lord Irwin, moved in.

Lutyens could do many things — a remarkably inventive architect and city planner, he also designed whimsical lamps for the children's nursery in the Viceroy's House and long-handled pruning shears and accompanying ladders for trimming topiary — but gardens were not his forte. In England, he had collaborated with Gertrude Jekyll, a noted gardener, on the country house estates that he was commissioned to design for the rich and famous. In India, where he knew even less about climate, soil and flora, he needed a knowledgeable and reliable partner to realise his grand vision of the city and its gardens. William Mustoe was that man. The son of a professional gardener, Mustoe went into service early, working for a series of private employers for 12 years before he got a job at the Royal Botanic Gardens at Kew in 1903. He was sent to India soon after and posted at the Government Gardens in Lahore. In his decade there, Mustoe worked on introducing many new plants, including testing 120 species of eucalyptus for their local suitability. He also experimented with roadside plantings and wrote a practical handbook on the subject.[19] It was probably this book that brought him to the attention of the authorities for, in 1915, he was called to Delhi to work on the new capital.



BELOW:
Delhi Town Planning Committee members Herbert Baker, Edwin Lutyens and George Swinton surveyed the prospective site by motorcar and on elephant and horseback
[Source: RIBApix]



ABOVE:
W.R. Munroe, William Mustoe and Edwin Lutyens in a garden on the Viceroy's Estate [Source: Marjorie Cartwright Shoosmith]

Lutyens and Mustoe met in 1919 and, over the next decade, during the three winter months when Lutyens was in town, the two breakfasted together every morning to plan and review the city's plantings.[20] Mustoe took over Talkatora Bagh, a dilapidated Mughal garden close to the Ridge, to establish a nursery. Already busy with afforesting the Ridge, he now started growing trees for New Delhi's avenues and government compounds. The main planting in the city began in the winter of 1919–20 and finished in the winter of 1928–29, when Mustoe turned his prodigious energies to the Viceroy's Estate.[21] Construction had left its detritus everywhere; Mustoe got rubble removed, soil and manure added, irrigation channels laid, before planting the trees, shrubs, creepers and annuals that he and Lutyens had selected. The focus of his work was on the formal gardens which Lutyens had designed in the Mughal style. Within months, he had enlivened the rigid geometry of Lutyens's sandstone terraces with masses of flowers, each bed a block of single colour for maximum effect. As a gratified Lutyens wrote to his wife, '[He] has done extraordinarily well with the gardens. Last winter they were a desert … Now full of roses and beautiful roses'.[22]

But it wasn't roses all the way. Disaster struck later that month when a snap of frost killed many of the plants. 'Mustoe was in tears. His car wouldn't start and he couldn't get to the gardens before sunrise to pour cold water on them to prevent ice thawing too quick and the Indian Mallis (*sic*) he found standing around doing nothing'.[23] The setback meant starting all over again, removing and replacing the rose bushes that had been grown with such care. Such reverses invariably dog the risky business of gardening, but their hazards were all the greater in a new setting, while the prestige of the project made the stakes that much higher. Fortunately, by the time the Viceroy's

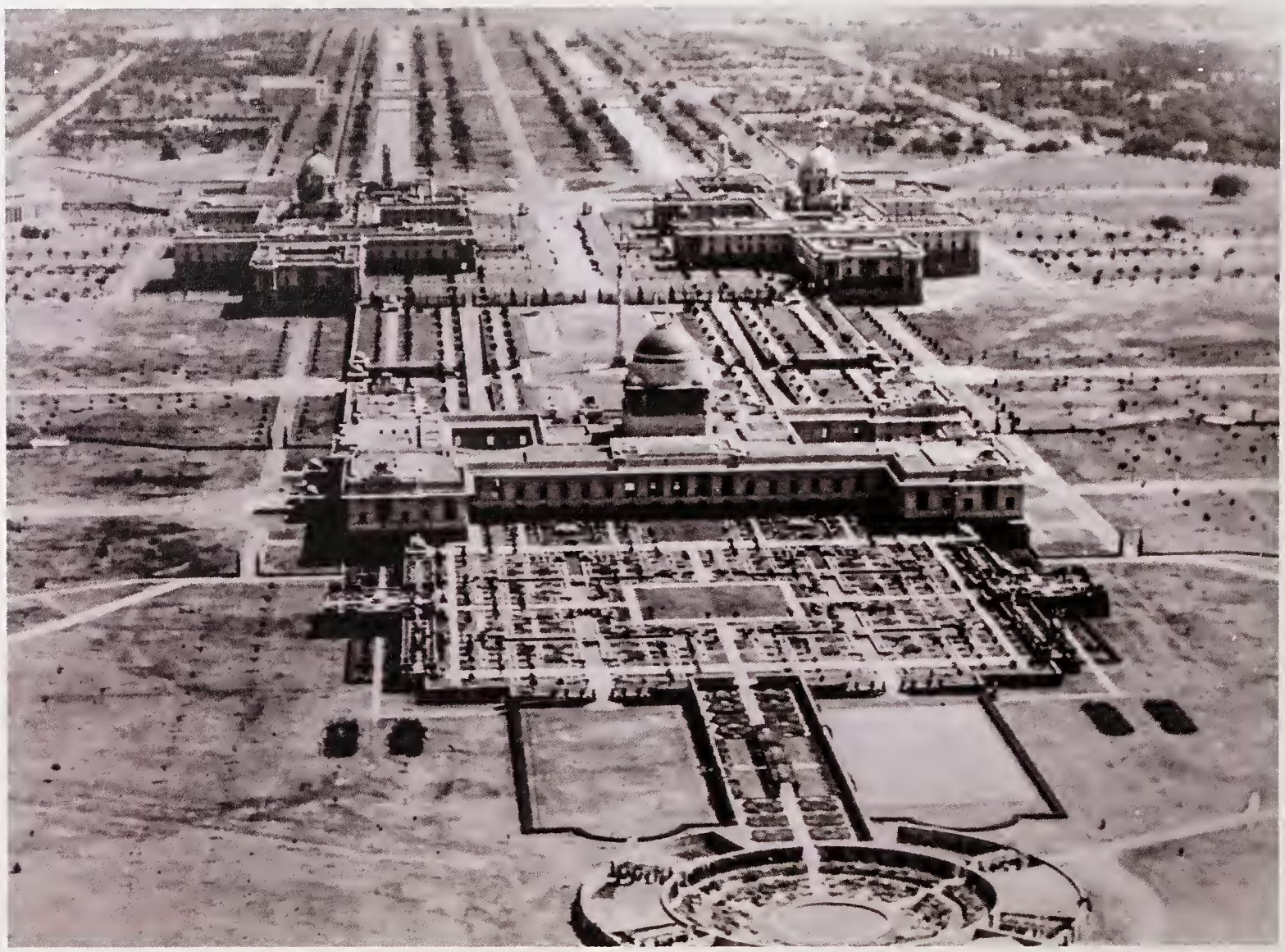


Estate was formally inaugurated in February 1931, the gardens were flourishing and garnered fulsome praise: 'Too lovely for words,' said Viceroy Lord Irwin.[24]

Around the formal gardens and Viceroy's House lay the rest of the Estate. In designing the layout of housing for the viceroy's civil and military staff, including his Bodyguard as well as the army of servants employed in the house and grounds, Lutyens followed the 'garden city' form that he had used for New Delhi.[25] He grouped the buildings into two compact villages at opposite ends of the Estate, separated from each other and from the Viceroy's House by large open spaces, the whole arranged in the geometrically precise layout that distinguished the new city. Avenues radiating out from two circles, one near the Bodyguard Lines and the other near the civil staff quarters (also called Schedule B), criss-crossed the Estate. The trees that were planted along them for shade and beauty are now part of the diverse habitat that the Estate provides for birds, insects and other living things.[26]

The ordered symmetry of the Estate was most emphatic in the Viceroy's Court, the ceremonial entrance to the mansion, with the Jaipur Column at its centre. The formality of the Forecourt called for uniformity; the grand scale of the driveway demanded equally imposing trees. Flamboyant bursts of seasonal colour or dramatic changes of foliage and flower would not be appropriate. The only species chosen was the laurel fig, its massive size and dense canopy giving it a gravitas that matched its role. Rows of these majestic trees flank the gravel path and twin sunken roads leading to the House. These symmetrical lines also extend beyond the ceremonial gates towards the North and South Blocks.

ABOVE:
Roses were William Mustoe's speciality and they remain a key feature of the formal gardens today



If the Forecourt and the formal gardens behind the Viceroy's House were primarily intended to impress visitors with imperial pomp, the rest of the Estate was designed to provide more domestic comforts to its residents, in the aristocratic style expected of their status. For their amusement, there were eight tennis courts (grass and clay), a cricket field, a polo ground, a swimming pool and a nine-hole golf course. (They could also go horse riding in the Ridge adjoining the Estate.) For their drawing rooms and kitchens came fresh flowers, fruit and vegetables from the Dalikhana, the 16-acre utility garden and orchard.[27] The garden staff numbered 418, of whom 50 were employed to scare off crop-raiding birds and another 20 to make flower arrangements.[28] The sprawling scale of the Viceroy's Estate was matched by an equally elaborate establishment to run the place, long after such extravagance had disappeared from the British stately homes on which it was modelled.

The other departure from the style of British mansions was the absence of parkland. From the eighteenth century, gardening fashions in Britain had shifted from formal gardens towards the romantic naturalism of creating 'landscapes' or scenic effects that mimicked an idealised view of nature. Grand homes were surrounded by acres of rolling parkland, artistic arrangements of open greensward dotted with picturesque lakes and copses of trees.[29] Many of the country homes that Lutyens had designed in Britain had flower gardens (planted to create the impression of drifts of colour in the informal style favoured by Gertrude Jekyll) beyond which lay parkland and, in the distance, woods. On the Viceroy's Estate as well, then, one would have expected that the formal gardens would give way to open parkland, a miniature countryside from which walkers and riders would get views of the big house. However, though vast by Indian standards, the Estate was not large enough to accommodate an extensive swathe of green. Instead, formal planes of lawn north and south of the Forecourt, and a field to the north at the end of the Mughal Garden, stand in as substitutes. Only the grassy undulations of the golf course provide a visual echo of the classic English park, while the dark smudge of the Ridge on the western horizon resembles the prospect of distant woods that completes the British landscape ideal.

LAYOUT OF THE PRESIDENT'S ESTATE



LEFT PAGE:
An early 1930s view of the Viceroy's House and gardens looking east towards India Gate. The saplings of pilkhan and laurel fig that dot this barren landscape are now massive trees
[Photo credit: E.E. Hall / The Lutyens Trust]

ABOVE:
Layout of the President's Estate
[Map credit: *LA, Journal of Landscape Architecture*]



The golf course, tennis courts, swimming pool and polo grounds were laid out to entertain the viceroy's family and visitors



ABOVE:
Musical fountains were installed near the formal gardens during President Abdul Kalam's tenure

RIGHT PAGE:
Jawaharlal Nehru, C. Rajagopalachari and Edwina Mountbatten in the Mughal Garden in the late 1940s
[Source: Rashtrapati Bhavan archives]

It took 17 years to build the Viceroy's Estate. Only another 16 years and the Indian empire over which it ruled had vanished. The departure of the British brought not only a new political regime — democracy — but a different ethos to the place, as it did to the rest of the country. The contrast was clear in the personae of the last viceroy, Lord Mountbatten, and the first Indian Governor General, C. Rajagopalachari. Dickie Mountbatten, tall and handsome in his admiral's uniform, was of aristocratic birth (Queen Victoria was present at his christening), and known for his love of ceremony. Rajaji, bald and bird-like, clad in a khadi dhoti and angavastram, was the son of a small-town *munsif* (judge), steeped in the Gandhian ideals of frugality and simplicity.[30] Rajaji was reluctant to live in a palace where every sumptuous square inch screamed of privilege, but was persuaded to do so by Jawaharlal Nehru, who pointed out that it would be costlier to maintain two houses, a large one and a small one. Rajaji, however, declined to stay in the viceroy's family suite, moving into more modest apartments in the north wing. At the same time, a large part of the building was given over to an Archaeological Museum where the public could see rare and beautiful works of art and heritage. The collection remained on the premises until 1960, when it moved to its permanent home at the National Museum on Janpath.

On 26 January 1950, India became a republic and Rajendra Prasad its first president. The Viceroy's House then became Rashtrapati Bhavan. Like Rajaji, Rajenbabu too was uncomfortable with the trappings of power. These were men who had brought their *charkhas* (spinning wheels) to the palace and who wore cloth from yarn spun by their own hands; living with the legacy of imperialism chafed against their spirit. 'I am in a zoo and a circus,' Rajaji told a friend.[31] The only solace of the place was the flower garden. At the start of summer in 1949, he wrote: 'I never before possessed this wealth … but now that I had it for a time I feel sad when I see the little things fade and die before their harsh father the sun.'[32]





ABOVE:
Spotted Deer being fed in their pen below the northern ramparts of the Mughal Garden

Dr Zakir Hussain, who succeeded Rajendra Prasad as President, found the gardens the only reward for living in the Rashtrapati Bhavan.

The democratic spirit that struggled for expression inside the Rashtrapati Bhavan affected the rest of the Estate as well. In solidarity with poor Indians, Rajaji used a part of the grounds to grow wheat as a gesture towards addressing the shortage of food in the country.[33] This practice continued during the 10 years of Rajenbabu's tenure.[34] More recently, the changing needs of small farmers led the Estate to experiment with planting trees that can be used as bio-fuels and to start a small unit for oil pressing, juice extraction and processing medicinal plants. With growing ecological consciousness have come initiatives to conserve water. In 1998, at K.R. Narayanan's request, the Centre for Science and Environment installed a system to capture rainwater for recharging groundwater on the Estate. In 2015, Pranab Mukherjee inaugurated a sewage treatment plant to supply recycled water for gardening while also filling up a reservoir to attract wetland birds. Pratibha Devisingh Patil started Roshni, a project to make the Estate a model for urban ecological sustainability, in 2008.[35] During her tenure, the Estate received ISO 14001:2004 certification for its solar lighting, vermicomposting, waste segregation and water harvesting.[36]

The most notable expression of the democratic impulse has been the opening up of the gardens and grounds to the public. As early as the Second World War, the formal gardens were opened in February and March when the flowers were at their best.[37] Today, they attract hundreds of visitors every year. After becoming President in 2002, Abdul Kalam vigorously expanded public access to the Estate. Lawns adjoining the formal gardens and facing North Avenue were converted into herbal gardens that display indigenous plants used in Ayurvedic and Unani medicine. Another section of the lawn was enclosed as a menagerie with Spotted Deer, rabbits and geese, next to a set of musical fountains in which jets of water play in time to patriotic tunes. Besides education and amusement, Abdul Kalam aimed at a more profound message in planting the Spiritual Garden, bringing together trees associated with

different religious traditions in the country. As Ram Singh, a gardener who worked to create the grove remarked, 'If 40 types of trees and shrubs can live together in harmony, then why not us humans?'[38]

If Lutyens were to visit the President's Estate today, he would encounter a greatly altered ecology, far greener and moister than he had left it. He would also find it much more crowded, its open spaces shrunk. The lawns to the north of the Forecourt and a section of those to its south have been replaced by nondescript buildings, part of the bulging bureaucracy spilling over from the North and South Block Secretariats. A massive auditorium and cultural centre sits athwart the field to the north of the formal gardens. In the middle of the roundabout in the civil staff quarters is a library building. New and urgent needs have cropped up in the intervening years: who could have imagined that car parking and security checkpoints would thrust themselves so aggressively on the landscape? Some of the changes are aesthetically dubious — for instance, the serried ranks of ashok trees trimmed into spindly mushroom shapes that proliferate across the Estate — but others are ecologically worrying. As the built environment expands, it swallows up green spaces that shelter plants and animals, and chokes off drainage for groundwater recharge. To be sure, the Estate is still a lot greener than most of the city, but this blessing cannot be taken for granted. While the Estate has a conservation plan that recommends limiting and even dismantling construction, the status of this plan is uncertain. A haphazard air also seems to pervade the avenues where it is hard to discern the reasons for the choice of new plantings. Why, for instance, was a row of New Caledonian pines planted near the newly created wetland where it looks out of place and does not even have the redeeming virtue of attracting birds? Is the aim to plant unusual species or to create a habitat using native plants? Both the goals are valid but they are better achieved if one is clear about which to pursue, why and how.

BELOW:
Shikakai flowers in the Spiritual Garden



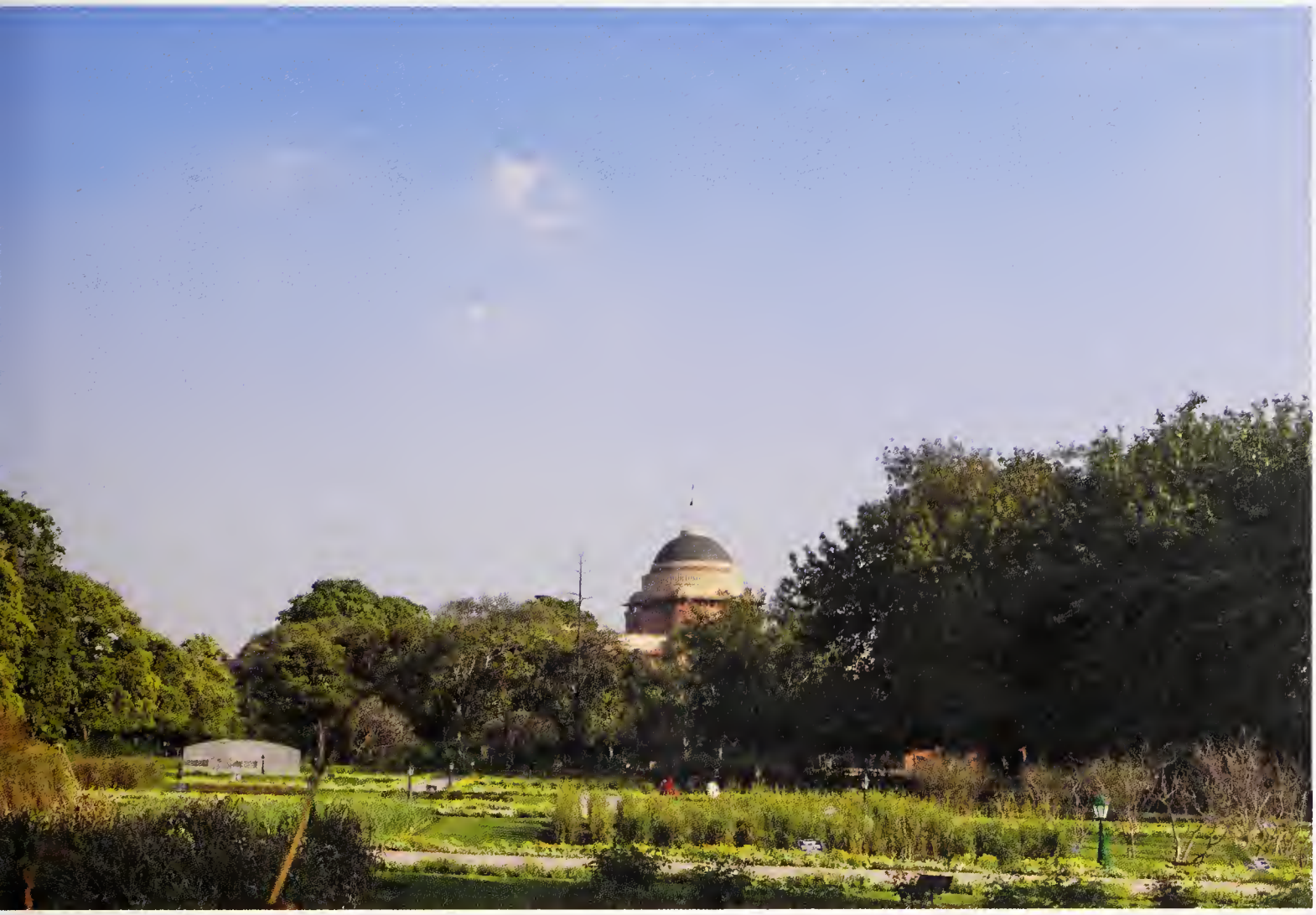
Finally, there is the question of history. The President's Estate is a living museum, built for imperial ends but inherited by a republic. How does one honour a heritage as complex as this? Perhaps our colonial past is too close for us to exercise a curatorial detachment about this legacy, perhaps as a nation we tend to let the past sit lightly on our shoulders, but our impulse to memorialise is weak. Lutyens was not so casual about what he had built. Incensed by reports that Lady Willingdon had made changes to the decor of the house and in the garden, he went to as far as Queen Mary to complain.[39] Once the Willingdons had left, their successor Lord Linlithgow invited Lutyens back to reinstate the original design. In 1938, Lutyens and Mustoe returned to the Viceroy's House; among other things, they removed the cypresses that Lady Willingdon had planted and restored the blue gum trees that she had had cut down to make a football pitch for soldiers.[40] What would Lutyens have said of the lopsided miscellany of gulmohur, royal palm, jamun and saptaparni that today flanks one half of the drive leading to North Avenue, an area that was meant to be a lawn?[41] Over the years,





ABOVE:
The herbal garden showcases plants used in Ayurveda and Unani medicine

RIGHT:
Malis repotting pansies to create a vertical display in the Long Garden for public viewing



original intents have sometimes been ignored, and sometimes followed unthinkingly, even when they have become obsolete. While the integrity of design must be respected, it cannot be sacrosanct either. Lutyens may have designed the golf course on the Estate as a requisite for its aristocratic residents, but should such a water-guzzling extravagance continue to be maintained today? Can we replace it with a field of native grasses? Such questions must be discussed and decided upon in conversation with historians, naturalists and residents of the Estate.

For those interested in flora and fauna, the President's Estate has much to offer: formal gardens famed for their setting and style; unusual and beautiful trees; and tangled pockets of wilderness that provide a glimpse into the native vegetation of the area. Moving across these varied habitats are the insects, birds, reptiles and small mammals that live on or visit the Estate. This volume introduces these natural elements of the Estate as well as the people who cultivate and conserve them. As this chapter has described, nature as we find it today was not simply there at Raisina Hill: it took intense effort and imagination to create it. So it is only fitting that we include within this book the men and women who work to keep the Estate going: those who rise before dawn to arrange flowers for the President's private rooms; those who crouch for hours weeding one flowerbed after another; those who sift piles of compost and leaf litter and pull heavy hosepipes from one end of the garden to another; those who select and store the seeds for next year; those who know exactly when to water so that the chrysanthemums all bloom precisely on the morning of the flower show; those who know the art of creating bonsai; and those who make sure that everything happens just as it should. It is to the *malis* (gardeners) of Rashtrapati Bhavan who work each day of the year to create beauty and life that this book is dedicated.

chapter two

The Formal Gardens

ENGLISH FLOWERS IN AN ISLAMIC CHARBAGH

AMITA BAVISKAR

A state reception is in full flow in the brilliantly lit ballroom that is now the Ashoka Hall. Bearers in red and gold livery steer silver trays of canapés through the clumps of gorgeous silks, dark suits and dashing uniforms. The rising hubbub of conversation relegates the genteel tones of a santoor player and his accompanists into the background. From the blazing chandeliers suspended from the richly painted ceiling down to the burgundy carpet, the room is a swirl of sound, light and spectacle.

A guest who turns away from this glittering scene for a moment and wanders over to the tall windows looks out on a very different world. Below lies a hushed garden where trees throw long shadows across dark lawns and flowerbeds. Tiny lamps pick out a path between shimmering pools of water, the flagstones damp with spray from the fountains. A breeze brings in the distant sound of chirping crickets. The mild sweet scent of maulsari wafts in. There is a sense of cool repose all the more marked for its contrast with the hectic pomp and protocol that prevails in the ballroom. The splendour inside makes the stillness outside seem doubly alluring.

As the sun rises, the spell of the night wears off and the garden once again assumes its stately aspect. The severe symmetry of sandstone and lawn imposes itself. The rigid grid of canals and crosswalks, the clipped Italian cypress and maulsari — each element is calibrated to be just so. Even the flowers, bursts of bright yellow, orange and pink, seem contained and circumspect, as if overpowered by their setting. In the flat light of day, the garden is at one with the grand house.

At first glance, the Mughal Garden matches the Rashtrapati Bhavan in expressing a sense of patrician authority and aloofness. It is well-groomed and very proper. Like the grey-blue dome that crowns the brow of the Bhavan, it suggests gravitas and restraint. Just as the dome, which was modelled on the stupa at Sanchi, has been acclaimed as an example of the unity of Indian and western design in Lutyens's architecture, the garden too has been admired for bringing together two very different horticultural traditions: the Mughal charbagh and the English flower garden. So, looking at the cool formalism that pervades this hybrid, it is intriguing to realise that the garden is based on what are, in fact, two deeply sentimental forms of nature.



THE CHARBAGH AND THE ENGLISH GARDEN



The Persians are credited with creating the exemplary charbagh or walled garden,[1] though the basic elements of the form existed across the Islamic world, from Morocco and Moorish Andalusia in the west to Mughal India in the east. In arid regions, a cloistered garden was a haven of water and shade, a contrast to the sun-battered scrub and sand that lay outside. The wildness of nature without was countered by the cultivated, watered vegetation within. This cool green relieved the heat in the house around it and provided a place of rest and pleasure. Pavilions and arched passages overlooked the garden, letting in scent-laden breeze, birdcalls and the sound of flowing water.

The Persians formalised these ideals into a classic design in which perimeter walls enclose a rectangular plot of land planted with trees and flowers, quartered by canals that meet in the middle, joining a fountain or pool. The four quadrants signify the fields of heaven and the canals invoke the rivers of milk and honey, water and wine that flow through the Garden of Eden. Fragrance and fruit were an intrinsic part of this harmony. Roses and citrus trees, narcissus and pomegranates were grown along rows of spreading chinar and the long-lived cypress, a symbol of eternity. Yet, while flowers, fruit and trees all mattered, the spirit of the charbagh was centred on running water, 'which alone makes all its other beauties possible'.[2] A spring flowing out of the roots of a tree was the symbol of eternal life and, for two and a half millennia, the Persians built *qanats*, underground ducts, to carry melted snow from the mountains to irrigate the arid plateau and bring heaven to earth. No wonder then that the word *pairi-daeza*, Persian for a walled garden, became the Greek *paradeisos* and the English paradise.[3]

The nomadic Mongols who invaded Persia in the thirteenth century carried the concept of the charbagh eastwards into Central Asia and across the Himalaya. Hilly terrain was terraced and mountain streams diverted to water almonds and apricots, pears and plums, lilies and irises.

This evolving tradition of gardening was brought to India in the early sixteenth century by Babur and his descendants. Although Babur considered himself a Turk, tracing his lineage to Timur and Genghis Khan, he was deeply influenced by Persian culture.[4] As his memoirs chronicle, he was dismayed by the heat and dust of the Indian subcontinent, its gruelling summers and arid plains, strange fruit and alien flowers. Homesick for the keen air, swift streams and orchards of his youth and childhood, Babur tried to recreate their memory beside the Jamuna at Agra in a garden called Aram Bagh.[5] Water from the river irrigated plums and peaches brought from colder climes as well as native jasmine and banana. Experimenting, lamenting the failure of his favourite temperate fruit and reluctantly coming to enjoy Indian melons and mangoes, Babur went on to build several gardens that incorporated native plants while staying faithful to the Persian ideal close to his heart.

While Babur's ideal garden was steeped in sentiment — nostalgia, religious piety, Persian aesthetics — it was in some ways also eminently suited to the Indian subcontinent. As Villiers-Stuart remarks:

> [T]he Turkestan Mughals were an intensely practical as well as artistic people ... India is a hot country, unbearably so in summer ... [I]n their new gardens by the Jumna the Mughals in time learned to adapt themselves to their altered surroundings. For one thing, they needed more water; water to cool the burning wind, big tanks to swim in as well as long sheets of water to charm the eye with their lovely tranquil reflections.[6]

Thus, the water of life in the Islamic garden came to be even more firmly entrenched in the layout of the Mughal garden.

PREVIOUS PAGE:
Italian cypresses, tulips and maulsari trees accentuate the crisp sandstone geometry of the Mughal Garden

RIGHT PAGE:
An illustration from the *Baburnama*, c. 1590, showing the Mughal emperor supervising work in his garden [Source: Wikimedia Commons]


درختهای انار هم بهست کرد اگر حوض تمام سه برگ آرد
جای عمن باغ همین است در وقت زرد شدن نارنجها بسیار

When situated by a river where wells and canals could be easily engineered to keep the water flowing, gardens gave full-throated expression to the fluvial motif. Villiers-Stuart's description of the garden around Humayun's tomb brings this out vividly:

> [M]arble or stone chutes were carved in various patterns, cut ingeniously at an angle so that the water running over them was thrown up and broken into ripples and splashes. Shell and wave designs were the favourites, and their name was as prettily fashioned as their carving — they were called *chadar*s, meaning white 'shawls' of water. These water-chutes … were used with much effect where the ground allowed for the garden being laid out in a series of high terraces. But in small gardens, or in the plains, even the slightest slope was made use of; only a foot or two of difference sufficed to create one of these charming little waterfalls, whose inspiration was directly drawn from memories of the dancing spray and white foam of mountain rivulets in the builder's northern home.[7]

While military campaigns kept Babur's son Humayun on the move for most of his life, later descendants like Akbar and Shah Jahan were more sedentary. As the Mughal Empire became better established, so did its riverside gardens. Akbar's city of Fatehpur Sikri near Agra and his grandson's Shahjahanabad in Delhi and Taj Mahal in Agra included elaborate gardens laid out in the Persian manner. Other noblemen, including Rajput rulers, followed suit, creating notable places such as the Shalimar Bagh in Lahore and the Pinjore Gardens near Chandigarh. An innovation was the *mahtab bagh*, moonlight garden, planted with pale scented flowers that bloomed at night. Soon, the charbagh became a regular feature of forts and havelis across North India, a lifestyle accessory for aristocrats, a marker of cultivated tastes. The skeletal forms of these enclosed gardens can still be seen in many places, though their plants have changed over the centuries.



BELOW:
Ancient chinar trees line the terraced tanks and canals of Nishat Bagh near Srinagar, built by Asif Khan in 1633 [Source: Dinodia Photo]



The English flower garden in India was no less a product of sentiment. Coming to a subcontinent where the climate, soils and vegetation seemed all too alien, British men — and especially women — struggled to create a sense of home. Around their bungalows and *kothis* (mansions), they laid out lawns and flowerbeds, paths and perennial borders to remind them of what they had left behind.[8] Emma Roberts observed that 'persons who have never quitted their native land, cannot imagine the passionate regrets experienced by the exile, who in the midst of the most gorgeous scene pines after the humblest objects surrounding that home'.[9] Among those longed-for sights and smells of home, familiar flowers figured large. Edith Cuthell's 1905 chronicle of gardening in Lucknow captured the sense of intense delight on successfully growing something from her distant country: 'My violets are in bloom! You cannot think how one treasures out here the quiet little "home" flower, buried in greenery … Dear little English flower!'[10]

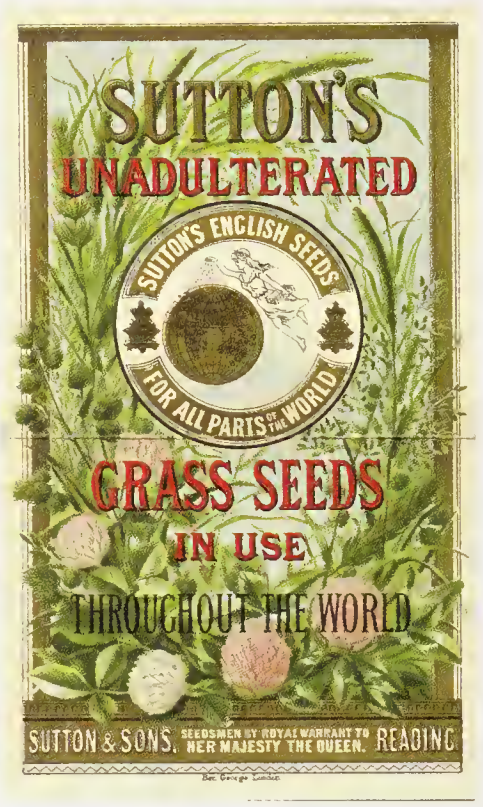


ABOVE:
An advertisement, c. 1905, for the seeds of violets or pansies — the names were used interchangeably in England
[Source: fotoLibra]

LEFT:
An 1867 photograph of a banyan tree at the Calcutta Botanical Garden, the site of several experiments in growing Indian and imported plants
[Photo credit: Samuel Bourne / The Alkazi Collection of Photography]

BELOW:
As this advertisement shows, the lawn was a symbol of Englishness exported all over the empire
[Source: fotoLibra]

BOTTOM:
Mowing the lawn with manpower and bullocks
[Source: fotoLibra]





Not everything English would grow in India. The trees and shrubs had to be native or from other tropical parts of the empire; temperate England's conifers, oaks, beeches and elms would not survive here. But annuals would thrive in the cooler months and so they sent away for seeds and bulbs from suppliers in Calcutta and Poona, gardening catalogues and manuals from England.[11] From Victorian times, gardening had become something of a secular religion in Britain. The thriving trade catering to its devotees had drawn on seeds and cuttings sent by intrepid plant collectors such as Joseph Hooker from their expeditions in the colonies and, later, from the more systematic collections made in places such as the botanic garden in Calcutta.[12] Plants from all over the world had been bred and acclimatised into English conditions and many of them went on to become staples in their gardens. Asters, violets, primulas, anemones, rhododendrons and geraniums were among the flowers from India to be so 'naturalised' that they were regarded as quintessentially English and loved for being so. Now the wheel turned full circle as flowers — some of them originally from India — came home to the colony, but as symbols of what it meant to be English, to make exile easier to bear. Edith Cuthell's beloved violets, 'dear little English flower[s],' may well have had parents from the Himalayan foothills. Such were the ironies of empire.

It was not easy to grow an English garden in India. In the northern plains, the seasons were daunting: scorching long summers, muggy monsoons and pleasant winters that ended all too soon. Plants had to be watered ten months of the year and each garden well had a Persian wheel and bullocks to draw up the copious quantities needed for irrigation. Flower seedlings had to be coaxed to grow with careful adjustments of light and temperature, water delicately sprayed 'by dipping a leaf in water and shaking it over the pans, [since] even the finest nozzle on a watering can would give too strong a jet of water'.[13] When they were big enough, they were transplanted into flowerbeds and pots prepared with soil, leaf mould and cow's manure, and lovingly tended until they burst into their brief glory. Even with an army of malis to do this hard, skilled work, it was an uncertain affair. Seeds ordered from England could be mouldy by the time they arrived. Those harvested locally would lose the qualities they had been bred for. A sudden snap of frost or a spell of drought could flatten young seedlings. Monkeys, antelope, rooting pigs and white ants could plunder and ravage at will.

The hardest to grow was the lawn. All the garden manuals provided detailed instructions for preparing the soil and looking after the grass. Since the finely textured English varieties could not be grown, the coarser Indian doob was planted. Those seeking the velvety look had to invest in diligent watering and manuring, strenuous weeding, mowing and rolling. All this and, come summer, the lawn still turned a dry, wiry brown. Yet, even though growing a lawn was a formidable, frustrating task, the sahibs did not give it up. A lawn was 'an absolute necessity'.[14] If the spirit of the Mughal charbagh lay in running water, the soul of the English garden lived in green turf.[15] Whether spread over undulating acres or the size of a pocket-handkerchief, a lawn was the element that threw the rest — flowerbeds, shrubbery and trees — into relief. It was also essential for social life: for parties and games of croquet and cricket. It was a sign of civilisation, of manners and taste, a way of



LEFT:
An English country garden around a tea planter's bungalow in Darjeeling
[Source: Sharyn Arthur, from the album of Teddy Young, 1948–68]

BELOW:
An English gardening catalogue from 1892
[Source: fotoLibra]



declaring one's distance from the natives. But above all, it was a symbol of home. Yearning to recreate that faraway world, the English transplanted their garden to India, its green grass and colourful flowers suffused with memories of the land left behind.

The Mughal Garden at the Rashtrapati Bhavan is thus not only rooted in Delhi, its climate and ecology, but also in other places connected by the criss-crossing lines of empire, commerce and cultural flows. Like the people who carried them around the world, the English and Persian garden styles were travellers and settlers: they went to new lands, struggled to adjust to strange surroundings, made new friends and foes, and sent presents home. Across the centuries, plants and the arts of growing them circulated so widely across the continents that they came to transform the original models. In the seventeenth century, the finest charbaghs were found not in Persia but in India. The English garden in Victorian times came to incorporate water features borrowed from Islamic gardening traditions. These mixed-up global histories are the routes that converge today at one place: the Mughal Garden on the President's Estate.

THE WOMEN BEHIND THE GARDEN

ALTHOUGH EDWIN LUTYENS designed the Mughal Garden, its original inspiration came from elsewhere. It was Constance Villiers-Stuart, author and painter, who passionately advocated the idea and campaigned vigorously for its inclusion in theViceroy's House. Her 1913 book, *Gardens of the Great Mughals*, traced the history and significance of the 'paradise garden' in India, lyrically describing still extant gardens in places such as Kashmir, Delhi and Agra. She wrote in the preface of her 'desire to illustrate the bearing of Indian garden-craft on the pressing problem of New Delhi'.[16] Villiers-Stuart argued that Indian gardens incorporated enduring cultural values, spiritual meanings and ecological adaptation. They also blended beautifully with the buildings around them. Adopting the Mughal style would be a salutary symbol of liberal British rule: 'If the palace at New Delhi could form part of a scheme with a great Imperial Indian garden ..., Indian art would receive a stimulus and Indian loyalty a lead which it would be impossible to overrate'.[17] Villiers-Stuart appealed to more parochial colonial sensibilities too, pointing out that:'We [need not] confine ourselves and our Indian craftsmen to imaginative reproductions of the past. New needs and our modern wealth of flowers would give fresh life and added beauty to ancient symbols and ideas, charms to rival and surpass all the older Shalimars'.[18] In London, she mobilised the Royal Society of Arts to support an 'Indian Garden' as a 'Royal Garden of Unity'.[19]





Constance Villiers-Stuart found an enthusiastic supporter in Lady Hardinge, the viceroy's wife. The Hardinges had been posted in Persia earlier and were familiar with the charbagh. A visit to Kashmir decided her and she wrote to Lutyens:

> I should love a Moghul garden with terraces to start from the very top of the Ridge and come to the house ... I have seen less good but the same style in Persia — water running down the centre with small falls from terrace to terrace, lovely stonework and steps, lots of fountains and of course flowers. I have asked for them all to be carefully photographed for your edification. I can only tell you that it was a *dream* of loveliness.[20]

Lutyens was quite willing to fall in with Lady Hardinge's wishes.[21] He had visited charbaghs during his visits to the Red Forts at Agra and Delhi and much preferred them to the Indian architecture that surrounded them. He was convinced that India had 'no real architecture and nothing built to last, not even the Taj' but the gardens of the Taj Mahal he found to be 'delicious — clear western skies, gorgeous colours and dark glossy trees and the pools and water channels full'.[22] In his career as an architect in Britain, Lutyens had had a long partnership with the renowned gardener Gertrude Jekyll; he provided the design and she selected and arranged the plants. Jekyll's interest in water gardens led her to write a little book on the subject and she was influenced by Islamic garden design.[23] Together, they had created a water garden at Hestercombe House in Somerset that was a radical departure from the naturalistic lakes and streams that were then the prevailing fashion.

Thus it was the influence of three women — Constance Villiers-Stuart, Lady Hardinge and Gertrude Jekyll — and the combination of their strong convictions, political skills and practical knowledge, that led to the design of the Mughal Garden at the Rashtrapati Bhavan.

ABOVE:
The pergola in the garden at Hestercombe House in Somerset, England, designed by Edwin Lutyens and Gertrude Jekyll resembles the one in the Long Garden on the President's Estate [Source: Wikimedia Commons]

LEFT PAGE:
The water garden at Hestercombe House was inspired by the charbagh [Source: Wikimedia Commons]



THE FORMAL GARDENS

THE FORMAL GARDENS are spread over 15 acres, stretching from the west of the house towards the Ridge. From the two wings of the house grow massive bastion-like walls of sandstone that enclose the raised terraces of the gardens. This enclosed space steps across the landscape in three parts, down to the level of the plain.

THE MUGHAL GARDEN

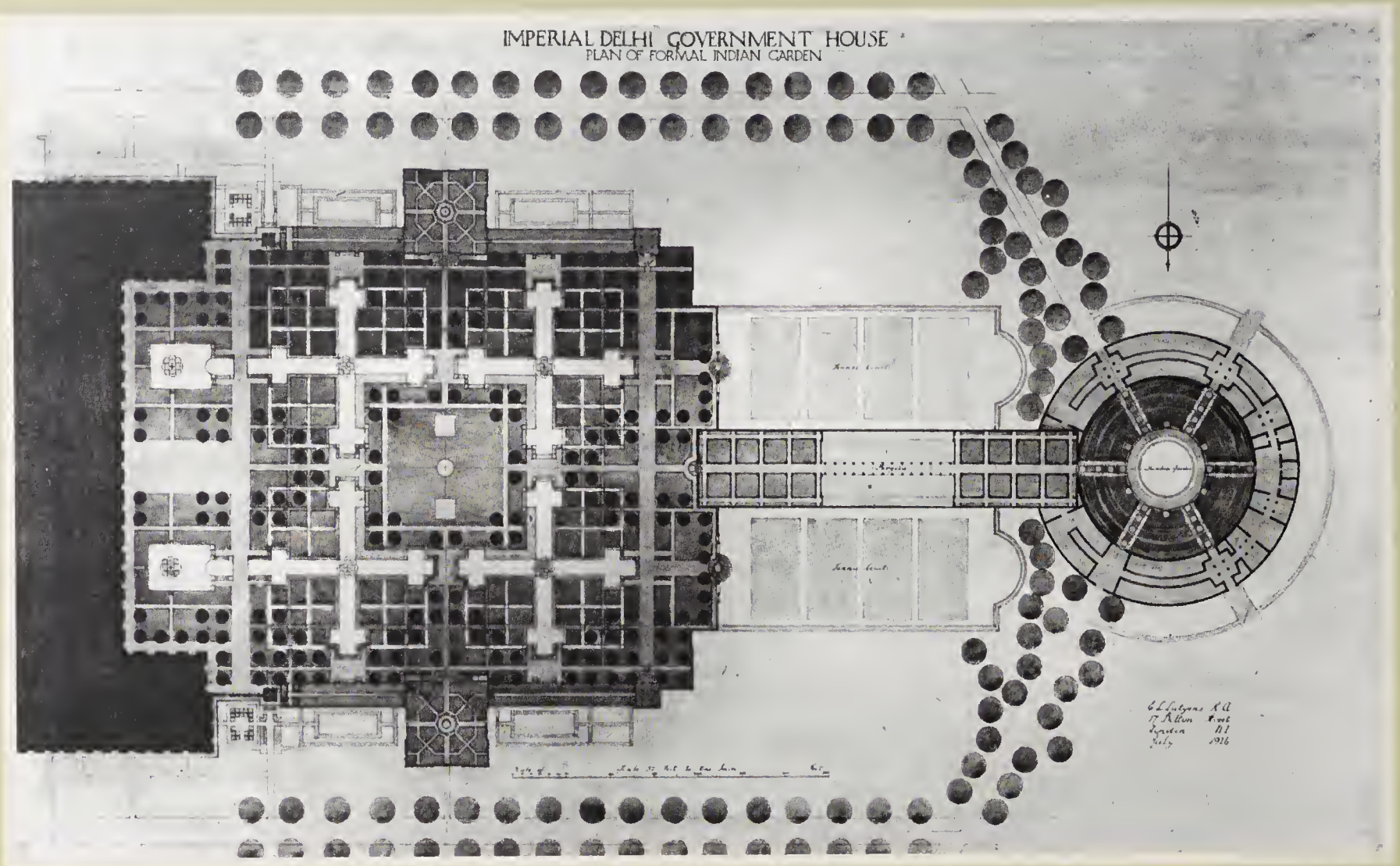
The Mughal Garden, nearest to the house, is so large that its design can only be discerned from the air or from the first storey of the Rashtrapati Bhavan. Standing at the windows of the State Ballroom or the West Garden Loggia, one sees a geometrically patterned expanse of pink and buff paths and parterres divided by tiled water channels, with a large square of lawn in the middle. Two parallel canals run north and south, intersecting with two others running east and west from square pools below the house. Where the canals cross each other, water spouts from fountains, trickling down three radiating tiers of sandstone carved lotus leaves. Symmetrical smaller channels, walkways, steps, and planters enclose plots of lawn and flowerbeds in an elaborate grid. Glossy-leaved maulsari trees, their dense foliage trimmed into tidy hemispheres, march alongside the main paths. The elegant Italian cypresses that once added height to the garden are now gone; Delhi's climate does not seem to agree with them. The younger plants are squat obelisks still, struggling to grow tall. Close to the house grow dwarf mandarin orange and gardenia trees, a passing nod towards the classic Mughal garden's emphasis on fruit and fragrance.



Two westward views of the Mughal Garden in 1931, soon after construction
[Photo credits: Arthur Gill / RIBApix]

LEFT:
The terraced garden looked out onto bare land then; now the tall gazebo in the distance is dwarfed by putranjiva trees

LEFT PAGE:
One of the canals in the garden with the clay tennis courts, empty fields of the Dalikhana and scrubby Ridge forest beyond



ABOVE:
Lutyens's original plan for the formal gardens; the two arms that extend from the Circular Garden were planted with pilkhan, only some of which survive today [Source: RIBApix]

RIGHT:
Kumquat trees in the Long Garden

RIGHT PAGE:
The formal gardens today: the Circular Garden in the foreground, the Long Garden in the middle distance, with the Mughal Garden closest to the Rashtrapati Bhavan





ABOVE:
Is the design of these multi-tiered fountains inspired by the shape of the Indian lotus? Some scholars assert that Lutyens actually based them on the leaves of the giant waterlily (*Victoria amazonica*), slyly paying homage to the former Empress of India
[Photo credit: Vishal Vishwakarma]

The garden path near the house ends in arched gazebos of sandstone, their skeletal lines framed by the graceful downward sweep of the big putranjiva trees growing behind them. Further along the periphery are somewhat forgettable architectural 'features' of the kind considered mandatory for stately gardens in England: the North Fort wall is punctuated by a grotto open to the sky where water cascades into a round pool and, in the South Fort wall, a fountain set in an octagonal pool throws water up into the air. The western end of the garden is walled by stone hoops covered with creepers, concealing the tennis courts that lie on either side. The surfeit of bland sandstone is relieved by little touches like the fishes incised into the floor of the smaller water channels, but it is the flowers most of all that lighten this overpowering stolidity. For eight months of the year, the climate allows only hardy species to be planted. The perennial rose bushes are dormant, putting forth only the occasional scrappy bloom. Through the summer and monsoons, beds of tall orange and yellow canna and variegated tapioca stand on duty, along with pink and white cosmos, mauve rosy periwinkle, salmon-hued portulaca and scented spikes of rajnigandha. This pastel palette is the everyday dress of the garden during the hot weather.

Late winter is the special season for the formal gardens. Pots of chrysanthemums appear in December, some with tightly curled yellow and white petals, others like starbursts of mauve and bronze, and some simply fat buttons of orange and purple. Behind them lie beds of annuals with their burgeoning bulbs, transplanted seedlings and rose bushes revived by the colder weather and heavy-duty feeding. In January,



LEFT:
In summer, the Mughal Garden is planted with hardy canna and rosy periwinkle

the buds begin to open. There are dozens of different species: tall dahlias, clarkia and sweet peas grow upright along the walls; banks of dimorphotheca and Michaelmas daisies spring up in great clusters; golden gazania, purple cineraria and scarlet salvia glow in the sunshine; orange calendula are flanked by violet larkspur and rainbow snapdragons; white alyssum and blue-and-pink phlox spill out of beds; sweet-scented stock and carnation gently perfume the air; velvety pansies sit next to frilly petunias; and neon-pink ice plants spread out on the ground. It is a medley of colours, shapes and smells, a multi-cuisine banquet for the senses.

The bulbs grow more primly. Each one is given its own space as if to signal its status as an expensive import.[24] Trumpets of heavy-scented Oriental lily, their curling stamens dripping with pollen, are prominently displayed. Pots of precious hyacinth, iris and freesia are placed alongside the more common spikes of gladiolus and narcissus. But it is the tulip that has pride of place. Something about its waxy plumpness — or the fact that Holland's stunning tulip fields have often been the setting for Hindi cinema song sequences — attracts crowds of admirers. There's a hint of the tulip mania that infected 17th century Europe in the adulation that the flower receives in Delhi.[25] Earlier Presidents were invariably photographed next to the roses; in the last decade, any picture of the President in the Mughal Garden includes a glowing bed of tulips.



BELOW:
Detail of fishes carved into the water shutes that link small pools on the rim of the Mughal Garden with its canals











RIGHT:
Roses, grape, purple wreath and juhi are among the climbers that soften the sandstone of the pergola

THE LONG GARDEN

ROSES STILL hold centrestage in the Long Garden, which lies a few steps below the Mughal Garden to its west. Enclosed by 12-foot-high walls, this passage has a creeper-hung pergola running through it that gives it a cool tunnel-like air. The cantilevered sandstone beams of this covered walkway are counterweighted by hanging pendants carved to resemble elephant trunks.[26] The ponderous feel of the pergola is lightened in March when the pretty flowers of purple wreath cluster overhead. The garden walls are draped with bignonia creepers with yellow and pink trumpet-shaped flowers that sunbirds love, glossy-leaved *Clerodendrum splendens* with bunches of maroon blossoms, and sweet-smelling star jasmine.

This sheltered setting encloses bed upon bed of hybrid tea roses gathered from around the world. William Mustoe, who planted the gardens,[27] was especially skilled at growing roses and is reported to have introduced more than 250 different varieties to the Mughal Garden.[28] Lady Beatrix Stanley, wife of the governor of Madras and a prominent horticulturist, paid Mustoe a great compliment when she wrote in 1931: 'I have never seen better roses anywhere in England'.[29] These rose bushes were nurtured and added to in the time of President Zakir Hussain but their numbers have dwindled over the years. When the arduous art of growing roses seems to be dying in Delhi — perhaps because of changing weather, perhaps due to the ease of buying flowers shipped in from elsewhere — it is the gardeners of the Rashtrapati Bhavan who keep this tradition going.

BELOW:
Beds of roses march alongside the pergola in the Long Garden







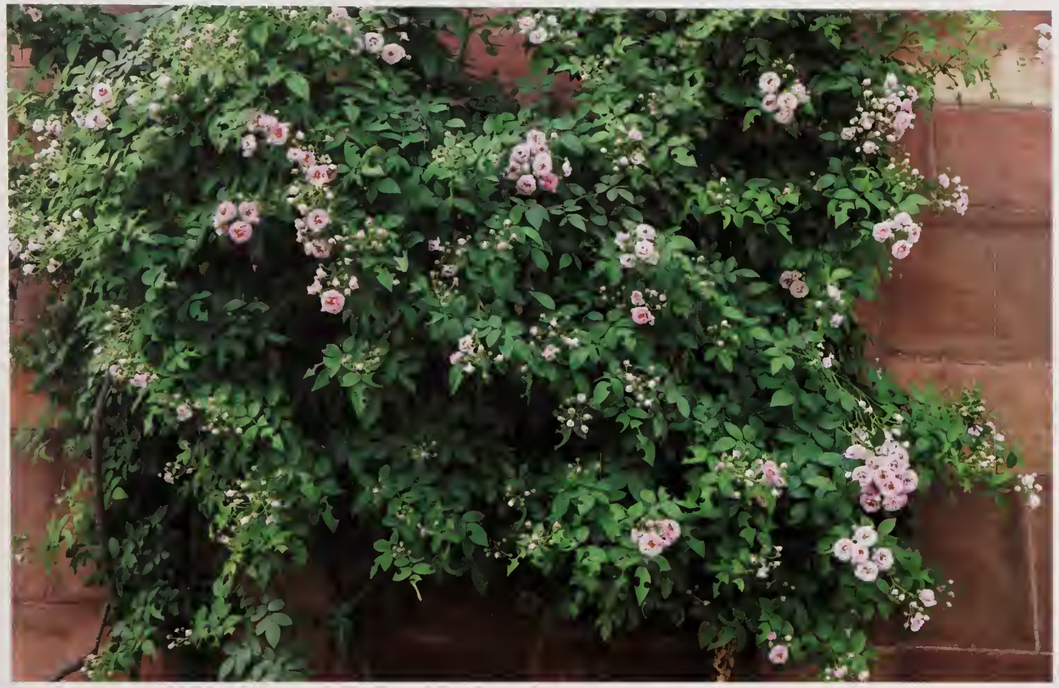








Rose varieties in the Long Garden (clockwise from left). Iceberg, Christian Dior, Scentimental, Landora, Montezuma, and Charleston





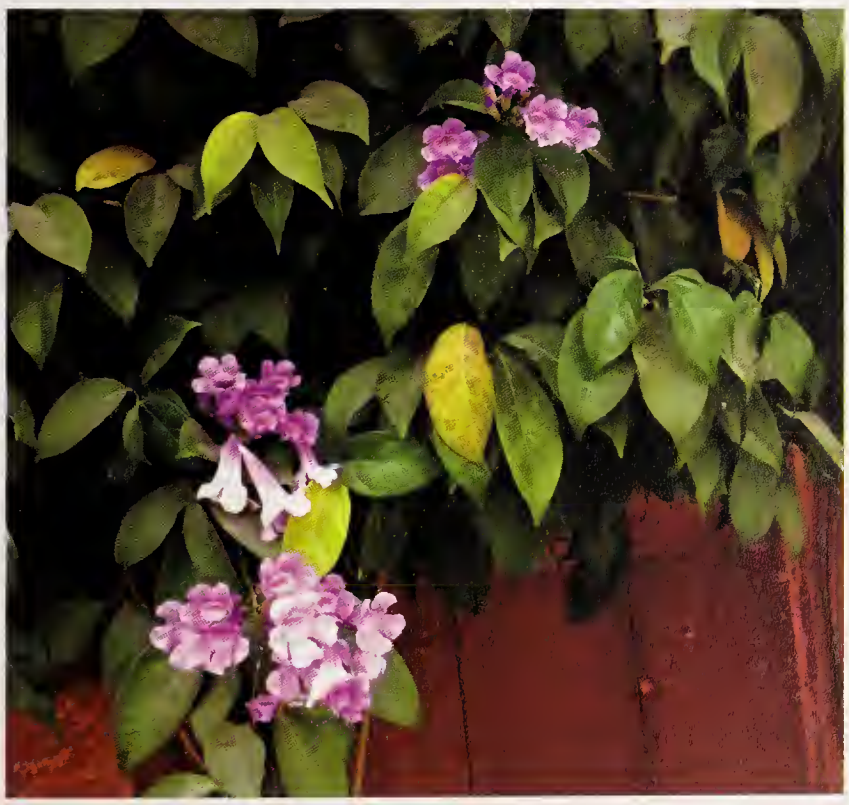


RIGHT:
Flowers of the flame vine cascade down the wall of the Long Garden in the spring

RIGHT PAGE ABOVE:
The Long Garden was originally planted in parterres of tightly clipped hedges enclosing flowerbeds, a formal French style that has now gone out of fashion
[Photo credit: Arthur Gill / RIBApix]

RIGHT PAGE BELOW:
Lassan bel (left) and trumpet vine (right)









THE CIRCULAR GARDEN

The Long Garden leads to the furthest and most secluded part of the formal gardens. Steps descend into a round amphitheatre where alternating tiers of flowers and lawn encircle a sunken pond with a fountain. This Butterfly Garden, as it was originally called, is the most English of Lutyens's creations on the Estate. High walls and a smaller scale give it an intimate air.

Here the viceroy would retreat with his wife from a world increasingly alien and uncertain to take afternoon tea and savour the last hour of the sun and its magic afterglow. Then a grey haze would steal over the gardens and, on the Ridge, jackals would cry at the moon. The fragrance of roses and mignonettes perfumed the air and, to Lutyens's delight, the fountains formed lunar rainbows.[30]

The Circular Garden, as it is now known, is at its most colourful in February-March when the brilliant tubular flowers of the flame vine festoon the tops of the wall, alongside white and magenta bougainvillea. Erect hollyhock and dahlia as large as cabbages stand tall, each top-heavy plant held upright by stakes. Below them grow banks of those classic 'English' flowers: verbena, phlox, petunia, stock and pinks. Even the sides of the tiered flowerbeds are covered with blossoms on gnarled vines of trellised purple wreath. The pond is edged with calendula and marigold. Bumblebees buzz and butterflies flutter around, spoiled for choice.















WINTER FLOWERS IN THE CIRCULAR GARDEN (clockwise from top left): stock, dahlia, pansy, larkspur, sweet william, phlox, lupin

APPRAISING THE GARDENS TODAY

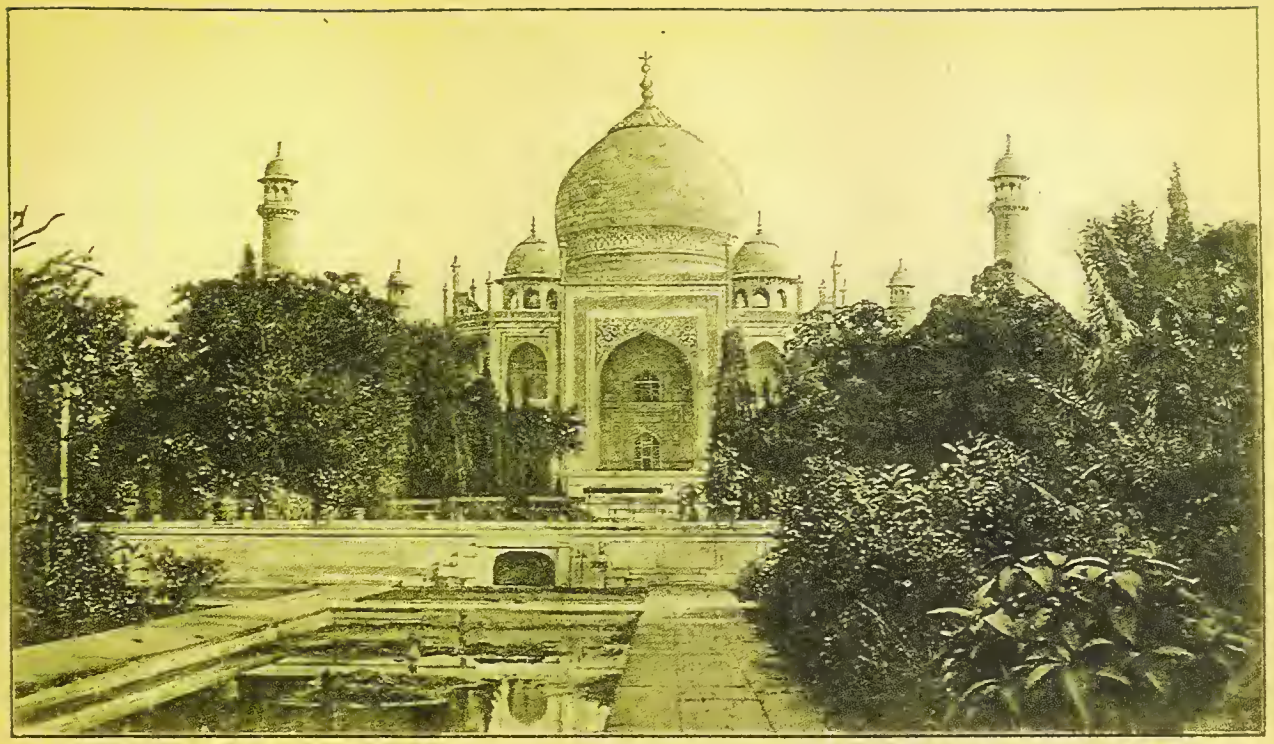
IN 1931, Lutyens and Mustoe were showered with praise for creating such beautiful gardens.[31] To grow flowers and trees where there was only rubble and rock, and to do so in a very short time, was a huge accomplishment. To be sure, the garden looked a little bare, but observers must have believed that it would mature, its built and cultivated elements growing into harmony. Today, more than 80 years later, have the gardens lived up to their promise?

The horticultural challenge of the formal gardens is one of Lutyens's making. In his previous architecture projects, he had worked with the more experienced Gertrude Jekyll who was in many ways his mentor. The 'hardscapes' that he designed were, from the start, balanced by the gardens she planned to plant. Also, most of their creations were in southern England where year-around rain and an equable climate provided a lush environment very different from the sharply marked seasons of Delhi. In designing the formal gardens of the Viceroy's House, Lutyens was working alone, for Mustoe was brought in only after the building was completed. It is this absence of a knowledgeable gardener at Lutyens's side at the time of design that may have led to the present problem: a garden where the living elements struggle to express themselves within the intimidating embrace of stone.

Another reason for this imbalance could be that Lutyens misunderstood the form and feel of a Mughal garden. The large gardens that were his models — the Taj Mahal and Humayun's Tomb — had been drastically altered by Lord Curzon during his energetic but idiosyncratic 'restoration' drives. Curzon wanted to cut clear sight lines to allow these monuments to be viewed from afar, so he ordered the culling of all the majestic trees that graced these gardens. Before this, the Taj was 'gloriously shaded by the foliage of ancestral … trees' which softened its silhouette and set the scene for a subtle drama: visitors were beguiled



RIGHT:
Planting maulsari trees in the Mughal Garden, c. 1928
[Source: CSAS, Cambridge University]



THE TAJ MAHAL, AGRA. *Page* 212.

by the cool sweetness of the garden, little knowing that the mausoleum would suddenly surge into view.[32] Curzon's clean sweep created a perspective that privileged eyes over experience, sight over smell, sound and touch. Lutyens's Mughal Garden, too, does not speak to all the senses and there is a nagging absence of sizeable trees.[33] Without such trees to add height and heft, the garden appears curiously flat and two-dimensional. The bald severity of the garden's built elements remains unbroken because the mellow grandeur of old trees is missing.

In the absence of trees and shrubs, it falls to the flowers to soften the hard lines of the stonework. Mustoe tried for an exuberant effect with flowers spilling out of containers and beds, using blocks of colours to suggest a heightened sense of mass.[34] This has now been replaced by a miscellany of hues.[35] A haphazard palette spread across discrete flowerbeds struggles to overcome the cumulative effect of stone paths, channels and steps, but fails. The plantings also seem to waver between two styles: the formal and the naturalistic. Some of the flowers — the tulip and calendula, for instance — are suited to uniform regimented grids whereas others — like the phlox and snapdragon — suggest a more relaxed, 'cottage-garden' feel. These qualities could be thoughtfully applied to create studied effects that give a special character to each section of the garden. For instance, the more intimate scale of the Circular Garden might be better served by herbaceous borders where sweeps of colours follow the colour wheel in the manner of Gertrude Jekyll's plantings. Even the spare rose bushes in the Long Garden would show to better effect if they were framed with other flowers across a stretch of lawn (as was the case earlier) instead of being crowded end to end like a field of cauliflower. The formal gardens are difficult to plant: they call for a design that responds to the aesthetic and ecological challenges of the place. Merely adding new plants will not do. A more informed and coherent approach is needed to make the gardens reach their potential within the sandstone straitjacket imposed by Lutyens.

ABOVE:
The lush gardens of the Taj Mahal before they were cleared by Lord Curzon
[Source: Edwin Arnold, *India Revisited*, 1906]

THE PRIVY GARDEN AND ITS PUBLIC LIFE

> At the central intersection of the water channels in the classic Mughal [charbagh] there would have been a raised stone platform, the *chabutra*, with a pavilion or simply a silken tent furnished with carpets and cushions. Here the ruler and his guests could catch the breezes from the water and the fragrances of flower and tree. In Lutyens's design there was no central intersection, but instead a large lawn between the channels, which … [represented] 'a symbolic triumph for the English way of gardening' as well as 'a carpet for the vice-regal garden party tent'.[36]

The central lawn of the Mughal Garden is planted afresh every five years with doob grass brought from Kolkata. In August, when Independence Day comes around and the President hosts an At Home, the lawn is ready for use. It is humid after the rains and pedestal fans swirl the heavy air around. The bittersweet scent of maulsari flowers crushed underfoot gives way to the aroma of samosas and mushroom vol-au-vents. White-gloved servers circulate with cups of tea. A velvet rope cordons off parliamentary leaders from the press of other guests; a barrage of flashbulbs shows media photographers hard at work. As peacocks cry in the distance, political adversaries put aside their antagonism and chat amicably. The English lawn in the Mughal Garden seems made precisely for such moments of tea, tact and truce.

A very different feeling pervades the formal gardens after Republic Day when the public is allowed to visit. The gardens are at their best in early spring and crowds of people line up patiently for entry at the North Avenue gate. On a sunny afternoon, groups of tourists, schoolchildren and families file past the flowerbeds, exclaiming at their beauty, stopping every now and then to take selfies. A group of women in silken burqas pause by the tulips and smile into the camera. A young couple poses beside the roses, their heads tilted towards each other. A father instructs his



RIGHT:
The President's Bodyguard in the Mughal Garden during a state reception [Photo credit: Dinesh Khanna]

RIGHT PAGE:
A floral *rangoli* greets President Pranab Mukherjee on the lawns of the Mughal Garden [Photo credit: Dinesh Khanna]





teenage children to move closer together so that he can make sure that the photo includes the blaze of colours in the backdrop. He is speaking in Marathi. From snatches of overheard conversations, one realises that there are also Tamil, German, Bengali, French and Gujarati speakers here. Almost five lakh visitors came to the gardens in 2016, attesting to the enduring popularity of the *gulistan*, flower garden, in public culture.[37]

Not all who come to the gardens are tourists. There are also gardeners from all over Delhi who look closely at the displays and take mental notes about the colour scheme, varieties planted and new species introduced. One stops to talk to the Rashtrapati Bhavan malis who sit by an intricate *rangoli* (floor decoration) made with marigold, nigella and chrysanthemum blossoms. These are the 'decoration malis', senior gardeners who now work indoors arranging flowers for the staterooms and the President's wing. They have grown old in service and know every aspect of making the garden flower; they once prepared the beds, grafted the roses and grew thousands of tiny seedlings; they removed the side shoots on the snapdragons and staked each individual chrysanthemum. Each year, the public opening of the formal gardens is the high point of their professional lives. For four months, their fellow-workers have laboured day and night just for this: that the gardens should look their best when the people come. As they sit amidst the flowers, surrounded by visitors who stroll and stop, look and linger, exclaim with delight and smile for the camera, this moment is their reward.





LEFT PAGE ABOVE:
A state reception in the Mughal Garden

THIS PAGE & LEFT PAGE BELOW:
Visitors and security personnel photograph themselves in the formal gardens when they are open to the public in spring





chapter three

Avenue & Forest Trees

UNRAVELLING THE PLANTING SCHEME

PRADIP KRISHEN

At 330 acres, the Rashtrapati Bhavan and its grounds are the largest residence of a head of state anywhere in the world. The main 'palace' occupies five acres. The smaller buildings — housing for subordinate staff, offices, museum, auditorium, and so on — possibly take up another ten or so acres. What's left — the grounds and gardens — sprawls over more than 300 acres. That's big.

By far the best known and most written about feature of the Estate is the 15-acre formal garden that was created as a westerly extension of the Viceroy's House.[1] This chapter looks with curiosity at the *rest* of the grounds beyond the formal gardens and, particularly, at the choice of tree species for the Estate's avenues and parks. In trying to understand why certain trees were chosen over others that were cultivated at the time, we will be poking around in the ashes of landscape and horticultural history. We have not found any direct information about how these tree species were chosen — least of all any plans or maps of the garden beyond the street layout of the Viceroy's House — but there is some information in the archival record that fuels speculation.

We will ponder over questions like: Were the avenue tree schemes of the Viceregal Estate cognate with the scheme devised for the new imperial capital? Why were some kinds of trees preferred over others and *who* was doing the choosing? We will mull over which trees may have been original to the plan and which ones are most likely to have been tacked on later. We will then peer with interest at patches of semi-wild Ridge forest that were allowed to endure inside a carefully planted landscape — was this by accident or intent? And finally, we will notice some of the more interesting or unusual forest trees that still survive in the Estate today.





President's Estate Central Ridge Lutyens's Delhi

CHOOSING THE TREES

Much has been made of a remark by Walter George that whenever Lutyens was in town — for three months every winter — he breakfasted with William Robertson Mustoe and, from 1919 through most of the 1920s, they pored over maps together and decided on which trees to plant along New Delhi's avenues.[2]

Walter George tells us that Lutyens found his alter ego in this Kew-trained gardener who was brought to Delhi after serving in the horticultural establishment of the Punjab. We know from other sources that Lutyens leaned heavily on Mustoe for providing the quintessentially English flowers that he wanted for his Mughal Garden.[3] So it would not be a surprise that Mustoe and Lutyens collaborated on the choice of trees for the Viceroy's Estate as well. Yet, there are a few niggling reasons for suspecting that this may not have happened.

Just as you can tell an artist's work by his brushwork and style, I believe that the avenue trees in the President's Estate do not carry the hallmark of Mustoe's oeuvre.

If you look at the matrix of avenues and even minor roads inside the President's Estate, you will see at once that it was intended to be part of the distinctive design of New Delhi's layout. Lutyens used the same geometry box he used for the new capital to create a set of miniature hexagons and focal roundabouts for the Viceregal Estate. This makes it even more probable that Mustoe would have handpicked tree species for these roads too, in much the way he is said to have chosen trees for the new capital city. But when you look at the actual avenue trees on the Estate, there's something slightly out of kilter here with the New Delhi tree scheme.

Let's look at some inferential evidence. Surprising as it may sound, New Delhi's *original* tree scheme boils down to just 13 species.[4] A few more species were added early on but, if we count all the species that were planted along avenues in Lutyens's Delhi before the 1950s, we end up with no more than 16 or 17 kinds of trees.[5] A few species failed and were replaced, so the total headcount is slightly higher. Nevertheless, 17 — or even 20 or 21 — is still a remarkably small number of species for a city criss-crossed by more than 40 avenues.

LEFT:
Maps showing the preponderance of jamun (above) and neem (below) in Lutyens's New Delhi
[Map credit: *LA, Journal of Landscape Architecture*]

The small number of species — together with the lists and debates around suitable tree species from 1912 onwards — suggests that these trees were chosen with *specific* intent. See, for example, this fragment from a 1912 report of the Town Planning Committee

> … For the purpose of getting the right effect from the design of an avenue both the size and shape of trees are of importance; and with this end in view the Committee have (*sic*) picked out 13 kinds of avenue trees out of a very large number, which will grow in Delhi … A deviation from the kind of tree selected to suit each avenue means a loss of a large general effect.[6]

So what were these carefully handpicked trees? We don't know *exactly*, but we can make out a clear pecking order within the avenue trees.

Of 17 extant species, five were clearly mainline species — favourites that were stamped at regular intervals, like hand-block prints, along several different avenues. They are: jamun, neem, arjun, imli, the sausage tree and baheda. You can see in the maps on the opposite page how liberally jamun and neem were planted in Lutyens's Delhi.

At a noticeably lower scale, five other species were planted *much* less frequently, some of them probably experimental in nature. Each of these five kinds of trees was used somewhat tentatively only along *single* avenues. They are: peepal, pilkhan, putranjiva, mahua and jadi.

A third category of trees includes six species in which the planners must have placed very little confidence. These were all *inter*-planted only along mixed avenues (in case they failed?) and each of them (except for khirni) only along a single road. These include the khirni, river red gum, maharukh, buddha's coconut, anjan and laurel fig.

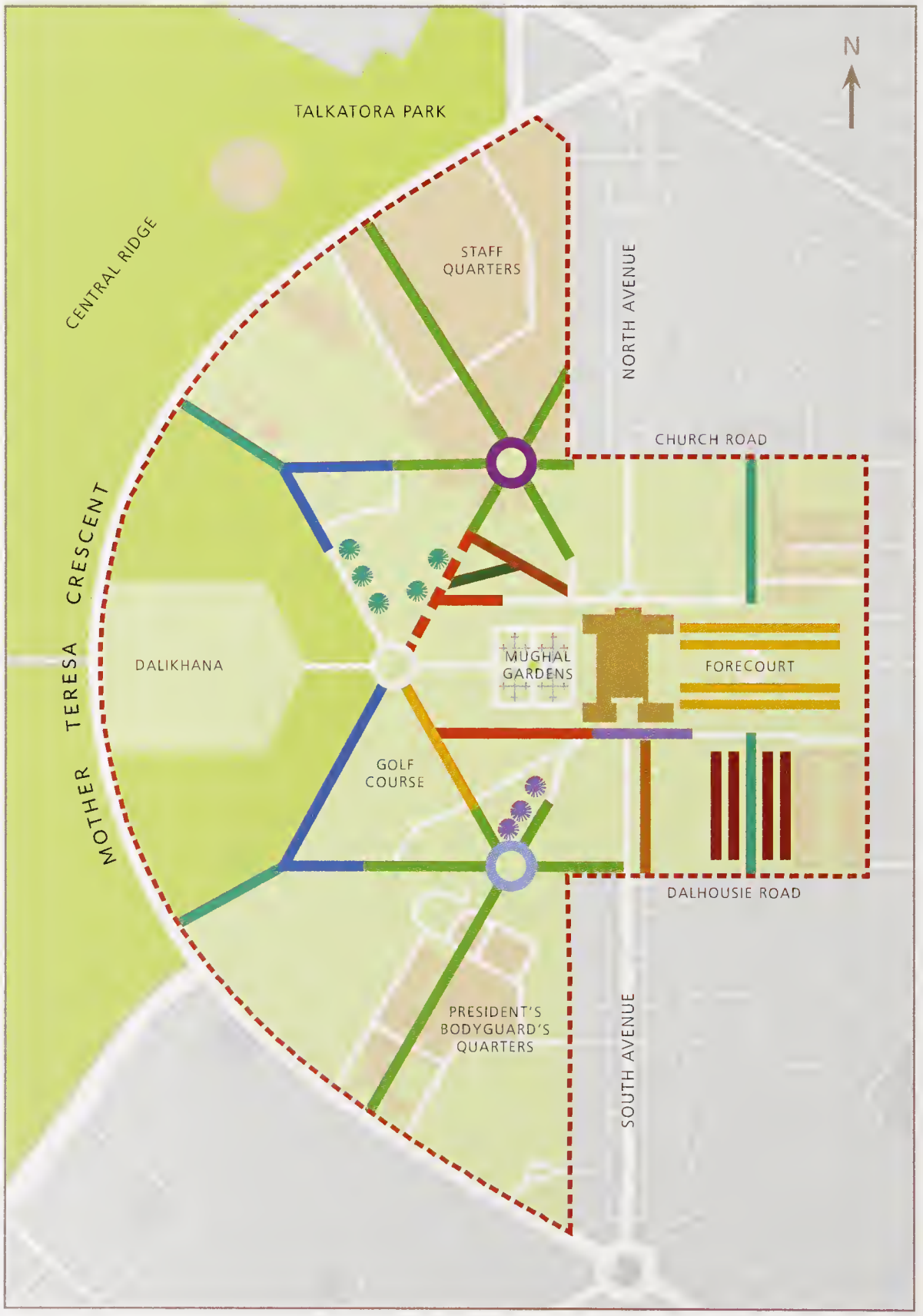
Of these 17 species, which were the ones selected by Mustoe? All of them? Some of them? We don't really know for sure, but if it is true, as Walter George says, that the scheme for New Delhi bears the stamp of Mustoe's preferred trees, it is hard to reconcile this scheme with what we can see today inside the President's Estate, or with what we can guess to be remnants of the original scheme. It is striking that *not a single one* of the mainline species of New Delhi was picked to line an avenue in the Viceroy's Estate.

Could it be that this was because Mustoe wanted to do things *differently* for the viceroy's stately home? This was without question the grandest demesne in the empire and it would not be unreasonable to expect a gardener to raise the bar to pick the most wonderful trees he could think of, avoiding anything that might be considered run-of-the-mill. Is it the case that the Estate grounds were planted with the best and proudest trees that Mustoe could think of, as he stepped carefully *around* his New Delhi scheme, avoiding trees and effects that had proved themselves in the new capital city?



LEFT:
Rai jamun trees on the lawns of Rajpath with the Rashtrapati Bhavan in the distance

AVENUE TREES OF THE PRESIDENT'S ESTATE



- *Banyan*
- *Chir Pine*
- *Jamun*
- *Khirni*
- *Karanj*
- *Kosam*
- *Laurel Fig*
- *Lemon-scented Gum*
- *Maulsari*
- *Pilkhan*
- *Putranjiva*
- *Royal Palm*
- *Saptaparni*
- *Sausage tree*
- Built-up area
- Jungle
- Rashtrapati Bhavan



THE ESTATE'S AVENUE TREES

IN THE President's Estate today, it is possible to identify only four or, stretching things a bit, five kinds of avenue trees which belong to the original planting scheme.

Pride of place belongs to karanj, liberally planted along several different avenues, much more so than any other kind of tree. The other avenue trees are: khirni, putranjiva, laurel fig and, only along one short span, maulsari.

Note that all of these species are either absent from New Delhi's original scheme, or figure in it only in a very minor key.

To these five trees, we can add four more species that were planted on either side of promenades or 'pseudo-avenues'.[7] They are: pilkhan, banyan, kosam and the sausage tree.

I'm going to say a little about each of these trees to see why or whether Mustoe might have picked them. I will refer in this discussion to two lists of suitable trees for New Delhi that were doing the rounds early in the 1910s. One is a list I will call 'Lutyens's Selection' from October 1912, which relied on suggestions that Lutyens received from two of Delhi's government gardeners, R.H. Locke and A.E.P. Griessen.[8] The second is 'Clutterbuck's List' from the same year, drawn up by a man Lord Hardinge considered 'about the most able Forest Officer in India'.[9]

Both these lists are likely to have exerted considerable influence on the choice of suitable trees for the new capital but they are also interesting because they provide us with a sense of what kinds of trees were available and valued as street trees early in the twentieth century.

I will also refer to a list that Mustoe himself prepared some time prior to 1915 when he served in the Punjab and wrote *Notes Upon Roadside Arboriculture*.[10] This will help us to see what Mustoe thought of several tree species before he came to Delhi.[11] I will refer to this list as 'Mustoe's *Notes*'.

ABOVE:
Putranjiva trees along Hukmibai Marg, the entrance to the Estate from Dalhousie Road. The trees behind them are kosams

LEFT PAGE:
Avenue trees of the President's Estate [Map credit: *LA, Journal of Landscape Architecture*]

KARANJ

KARANJ has a tendency to develop an ungainly, portly trunk and to become progressively untidy as it ages, so it is a little surprising to find it dominating Rashtrapati Bhavan's avenues like none other. It does not figure at all in New Delhi's avenue tree scheme but here this tree was clearly intended as the *primus inter pares* of the Estate's avenue trees. Is it possible that Mustoe chose this tree for the Viceregal Estate because it wasn't a common avenue tree in the new capital? Because it was different?

If karanj was favourably regarded by horticulturists of the time, we would expect to find it cropping up in some of the other 'Lists' but it does not figure at all in Lutyens's Selection. Clutterbuck treats it as an 'Avenue Tree Second Class', and karanj finds not a mention in Mustoe's *Notes* where he details six recommended 'varieties for roadside planting', and not even in the 21 additional trees that he lists in 'Trees Suitable for Planting Among Civil Stations or Where Variety is Desired'. It does not seem that Mustoe took karanj into consideration at all.

So it is somewhat puzzling why karanj got planted so extensively on the grandest estate in the land.

Karanj is native to tidal flats and riverbanks in coastal India and Myanmar, but is known also for its ability to withstand relatively dry conditions. Descriptions of karanj make much of the fact that it is 'nearly evergreen', renewing its leaves in May after only a short bare period, and this could have been a factor in choosing karanj for the Viceroy's House.[13] Today, a common reason for planting karanj as a city tree is because its leaves are unpalatable to browsers and it does not therefore need to be enclosed and protected. But this could hardly have been a consideration for Mustoe, certainly not inside the Viceregal Estate. Why then would he pick it?

ABOVE:
Stocky and somewhat untidy karanj trees line several avenues on the Estate

RIGHT PAGE ABOVE:
Karanj in flower in April-May
[Photo credit: Pradip Krishen]

BELOW:
Putranjiva foliage
[Photo credit: Pradip Krishen]

I have pointed out elsewhere that being evergreen, especially in dry environments, was a tree character preferred by British landscapers of that time.[14] This could have weighed in favour of karanj. There was also, from the very beginning, a clear sense that planners did not want the new capital to be planted up with trees regarded as 'common'. Karanj was not at all common in New Delhi at that time.

So karanj might have been picked for the Viceregal Estate because it ticked both boxes for 'evergreen' and 'uncommon'. But it is not an attractive tree. It is true that karanj looks lovely in new leaf, though only for about two weeks or so early in May. On the other hand, karanj is not nearly as evergreen in Delhi as Mustoe or the planners might have thought or hoped, adjusting, as most trees do, to the stress of Delhi's long, dry period by shedding its leaves. Karanj also suffers in Delhi from a leaf-mining creature that causes its leaves to break out in ugly brown blisters.

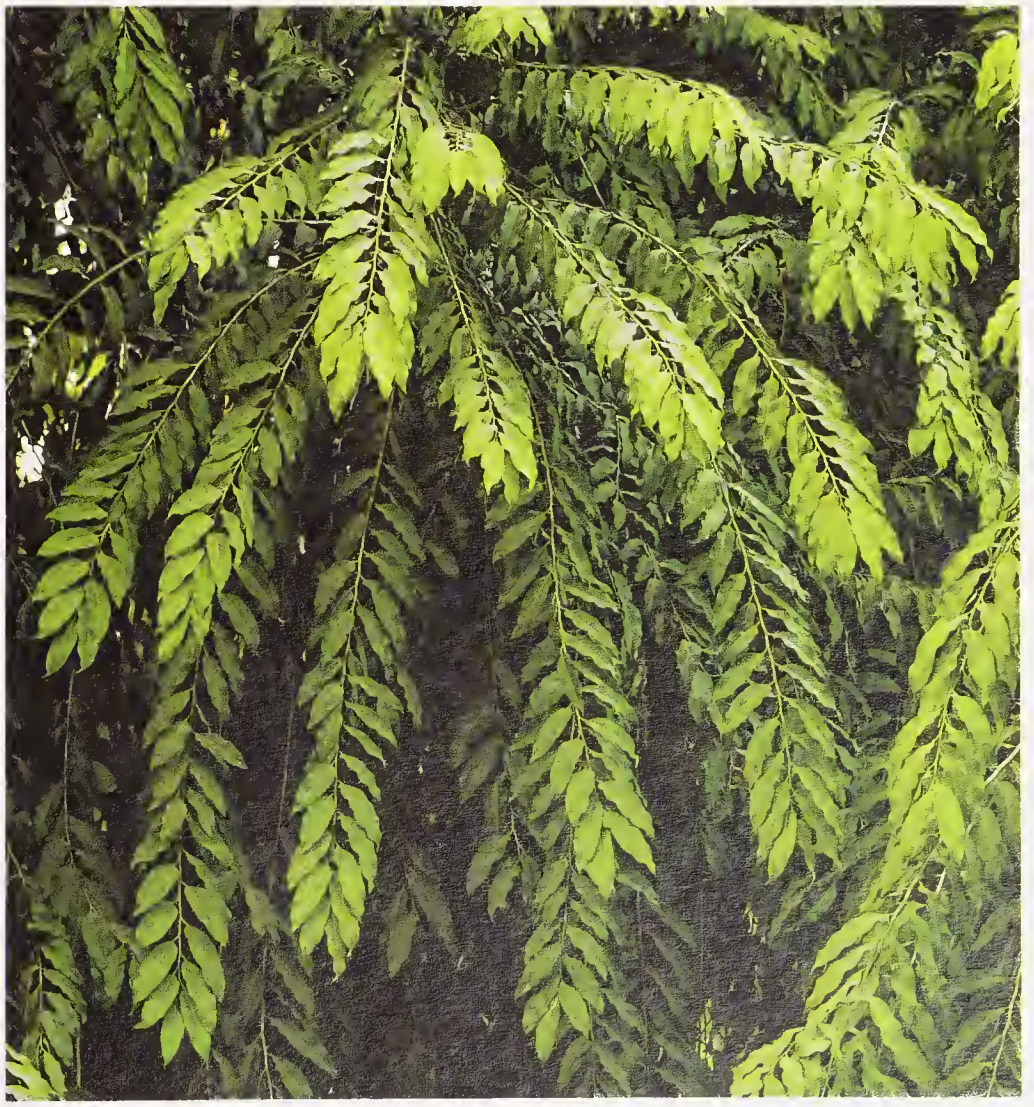
All things considered, karanj doesn't seem to me at all like a highly-rated candidate for a viceregal Estate.



PUTRANJIVA

THIS IS an evergreen tree from moist sub-Himalayan tracts (also the southern Deccan) that is a much more likely candidate for planting in a grand design. In New Delhi's scheme, putranjiva was planted with restraint only along Race Course Road, and the most likely reason was that no one was quite sure how it would fare in Delhi. By the early 1930s or so, it is possible that putranjiva had proved itself, adapting admirably to Delhi's soil and climate.

It doesn't have conspicuous, ornamental flowers but putranjiva's chief attraction lies in the grace and beauty of its foliage which is arranged neatly on either side of long drooping twigs. Putranjiva was not common (at the time), so on two counts that mattered — 'not-common' and 'evergreen' — putranjiva sails in without causing any one of us today to furrow our brows and wonder why anyone would have picked it.







Putranjiva had proved itself as an evergreen avenue tree before it was planted on the Viceregal Estate

MAULSARI

MAULSARIS — like the khirnis to which they are closely allied — are extremely slow growing trees and are not, largely for this reason, often planted along city streets. They are more suited to formal gardens — there are lots of them inside the Rashtrapati Bhavan's Mughal Garden — because they lend themselves admirably to decorative topiary. On the Estate, maulsaris have been used with evident restraint as avenue trees, forming only a short stretch close to the main building along its southern flank.

Maulsaris originate in places in southern India and South-East Asia that are a lot moister than Delhi. They were planted prominently east of Vijay Chowk (the Great Place) in the midst of well-watered lawns and it is reasonable to assume that horticulturists knew well enough that they would struggle as avenue trees in Delhi's dry climate.

Like many tree species that are adapted to a unique, twice-a-year monsoon in peninsular India and Sri Lanka, maulsaris are evergreen, and this probably explains their presence in the viceregal scheme. There is no doubt that they become very handsome when they are middle-aged, with dense, rounded crowns of glossy leaves, but they take rather a long time getting there.

Like the putranjiva, maulsari ticks both boxes — 'evergreen' and 'not-common' — so it is possible but, to my mind, somewhat unlikely that Mustoe would have picked this tree as suitable for planting along an avenue on the Estate.

BELOW:
Lutyens may have borrowed the idea of using maulsari in topiaries from the Mughal gardens he visited during his tour of Indian architecture





KHIRNI

KHIRNI is a slow-growing tree with a sombre, spreading canopy. Its natural habitat is dry evergreen forests in the Deccan and Sri Lanka. We know that khirnis are capable of growing to a great age — khirnis planted by the Khilji sultans of Mandu (in Malwa, central India) are over six centuries old and make magnificent consorts to the Afghani architecture with which they are coeval.

Did British horticulturists know this?

If so, it might just have been a factor in choosing them for the Viceroy's Estate. We know that Lutyens travelled to Mandu as part of his heuristic Indian-architecture-darshan tour, so it's entirely possible that he noticed and admired Mandu's monumental khirnis and might have endorsed them when faced with a choice.

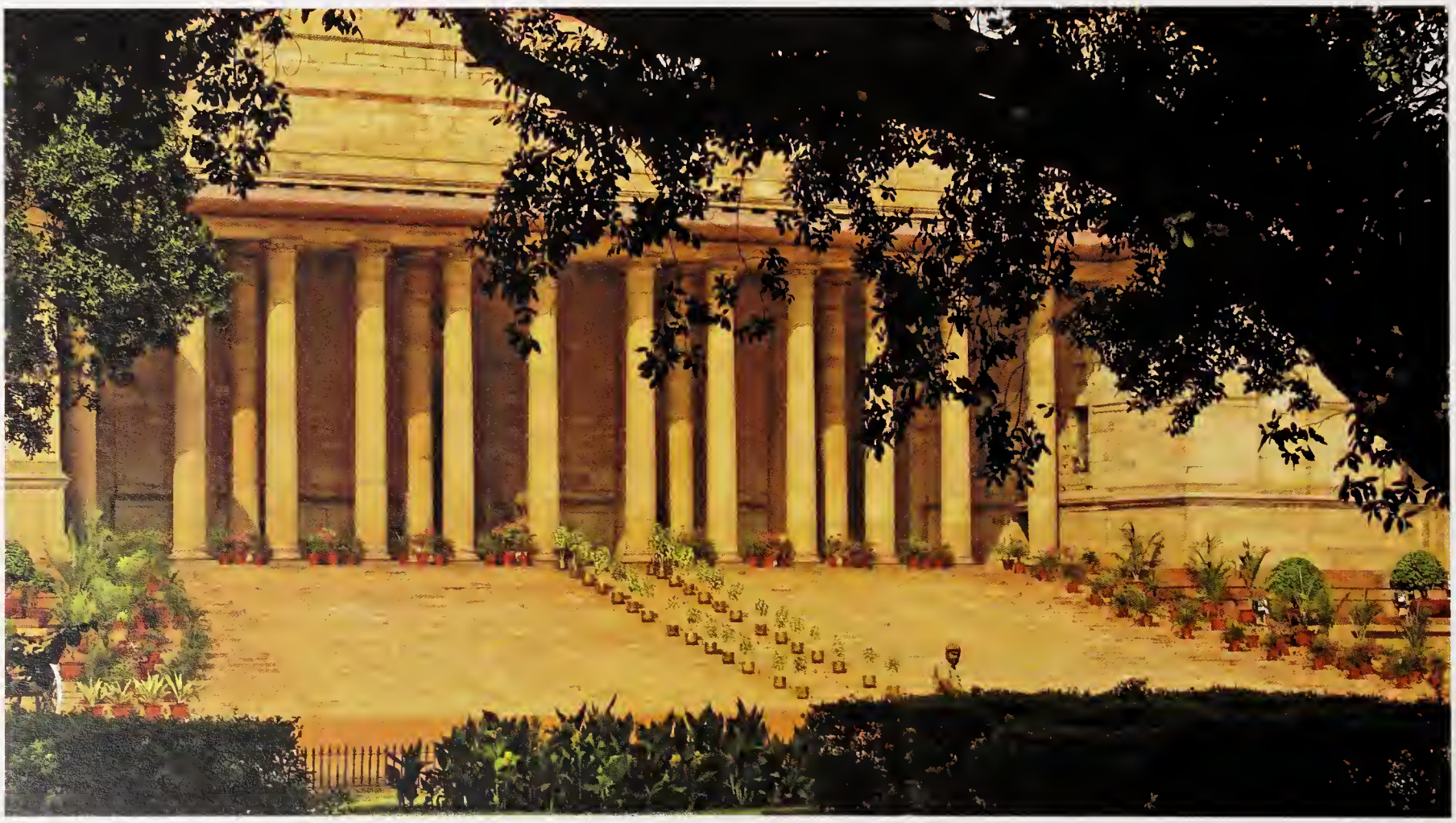
But even in the late 1920s, there were a few counter-reasons for *not* picking khirnis. Mustoe (or someone) had picked them to line Man Singh Road and King Edward Road (now called Maulana Azad Road) in *mixed* plantations in New Delhi, and here they made painfully slow progress. Even today, nearly a century on, the khirnis of central Delhi are diminutive straggly editions of their central Indian kin. Khirnis are known to be adaptable and capable of growing in almost pure sand, on gravel, loam, laterite and limestone, but Delhi is clearly not the most suitable place to grow this tree and by 1930 or so, Mustoe would surely have noticed this.

Inside the President's Estate today, the avenues of khirni are depleted and ragged. Some have died and been replaced by other trees. Those that remain soldier on, but they do not make up an impressive colonnade.

The khirni is another tree I find difficult to attribute to a discerning gardener's choice.

ABOVE:
The khirni avenues have not fared well







LAUREL FIG

THE LAUREL FIGS of the Rashtrapati Bhavan are a little problematic because we do not know for sure what subspecies they are and where they are from. One form that is seen through much of central India and the northern Deccan, for example, occupies hyper-rocky habitats, perching impressively on the tops of sandstone or granite outcrops with trailing aerial roots and huge up-thrusting branches. The laurel figs of the President's Estate are definitely not this sub-species.

The Estate's laurel figs might be ones that are found — not so commonly — in the sub-Himalayan region north of the Gangetic plain. They might even conceivably be from another country — somewhere in South-East Asia, perhaps, or south China. The species *Ficus microcarpa* is a complex of forms that no one seems to have sorted out very well.

Wherever they are from originally, the President's Estate's laurel figs are magnificent! Laurel figs are not used as avenue trees for the same reason that all fig trees (species of *Ficus*) are best avoided: because their spreading surface roots are prone to lifting pavements and kerbsides. In New Delhi's scheme, laurel figs are deployed only on a few large roundabouts — notably York Place (Motilal Nehru Place today) — though of course it is entirely possible that the planting in York Place came later, inspired by the laurel fig's success inside the Viceroy's Estate! No matter which came first, it was an inspired thought to pick them, because I have not seen laurel figs used like this anywhere else in this country.

The Estate's laurel figs have been planted in straight-files to form a distant, magisterial vista on both sides of the ceremonial concourse in front. Interestingly, there are more laurel figs just outside the Rashtrapati Bhavan's front gates, in and around North and South Blocks of the Secretariat, as if someone was trying to create a thematic link with the precinct. As a design element, it works very well. This particular form of laurel fig is more or less evergreen too, so if there is a single tree that ticks *all* the boxes as an inspired choice, it has to be the laurel fig.[15]

ABOVE:
The ceremonial driveway leading to the Rashtrapati Bhavan and the Jaipur Column is lined with laurel figs [Photo credit: Pradip Krishen]

LEFT PAGE:
East Front steps of the Rashtrapati Bhavan framed by laurel figs in the Forecourt [Photo credit: Gavin Chappell / The Lutyens Trust]





ABOVE:
It is difficult to tell whether this picture of the ceremonial driveway from the late 1920s shows young laurel figs. The tree was not a tried and tested avenue tree and it is possible, though unlikely, that it was a later addition.
[Photo credit: E.E.Hall / The Lutyens Trust]

RIGHT:
Laurel figs around the Forecourt

RIGHT PAGE:
Aerial view of the putranjiva avenue leading to the Jaipur Column
[Photo credit: Gavin Chappell / The Lutyens Trust]



PILKHAN

NOW WE COME to the four species of trees that were deployed along both sides of walkways on the Viceregal Estate.

Here's a tree that was used in just a few of the avenues of Lutyens's Delhi — on Wellesley Road (now Zakir Hussain Marg) and Dalhousie Road (whose name, miraculously, is unchanged) which runs just outside the Estate's southern boundary — and is beautiful, especially in early March when it renews its foliage. Pilkhans have enormous, wide-spreading canopies and, of course, are fig trees, so they are never good candidates for planting near roads or kerbsides. It was a sensible idea to use pilkhans inside the Rashtrapati Bhavan only along 'pseudo-avenues', one on each side of the main palace, where the thoroughfares they line are promenades, not roads.

In my opinion, pilkhans are an excellent choice of tree for the Rashtrapati Bhavan — incredibly broad in their expanse, beautiful in their bronzy-rusty phase as they renew their leaves in Delhi's spring. Sadly, many of the trees inside the Estate have been badly treated with their branches trimmed harshly back, so their general appearance is not as lovely as it might have been.

Marks out of ten? Maybe a six or seven, and in this instance I can believe that someone like Mustoe could have chosen the pilkhan for the way it has proved itself in New Delhi.

RIGHT PAGE:
The pilkhan is a tree that shows its mercurial nature when it puts on new leaves in February-March in Delhi, changing each day

BELOW:
A shady pilkhan avenue in early summer





BANYAN

THE BANYAN is yet another fig tree and, because of its sheer size, it is perfectly understandable that even more so than other fig trees, banyans were not — or were only very rarely — used as avenue trees. Unlike the other, more modest fig trees, however, the banyan is a tree-who-walks, expanding its canopy by throwing down sturdy prop-roots and colonising ever more territory as it grows older. (The largest banyan tree in India sprawls across more than 3 hectares.)

While it may not make a well-behaved roadside tree, the banyan enjoys iconic status as the giant strangler-fig of the Indies, and it is easy to see why an arboriculturist — especially an English arboriculturist — would want some banyans on the Estate. The fact that this tree is planted more or less in a straight line is slightly quirky (for a tree that has so little linearity) but provides an interesting effect.

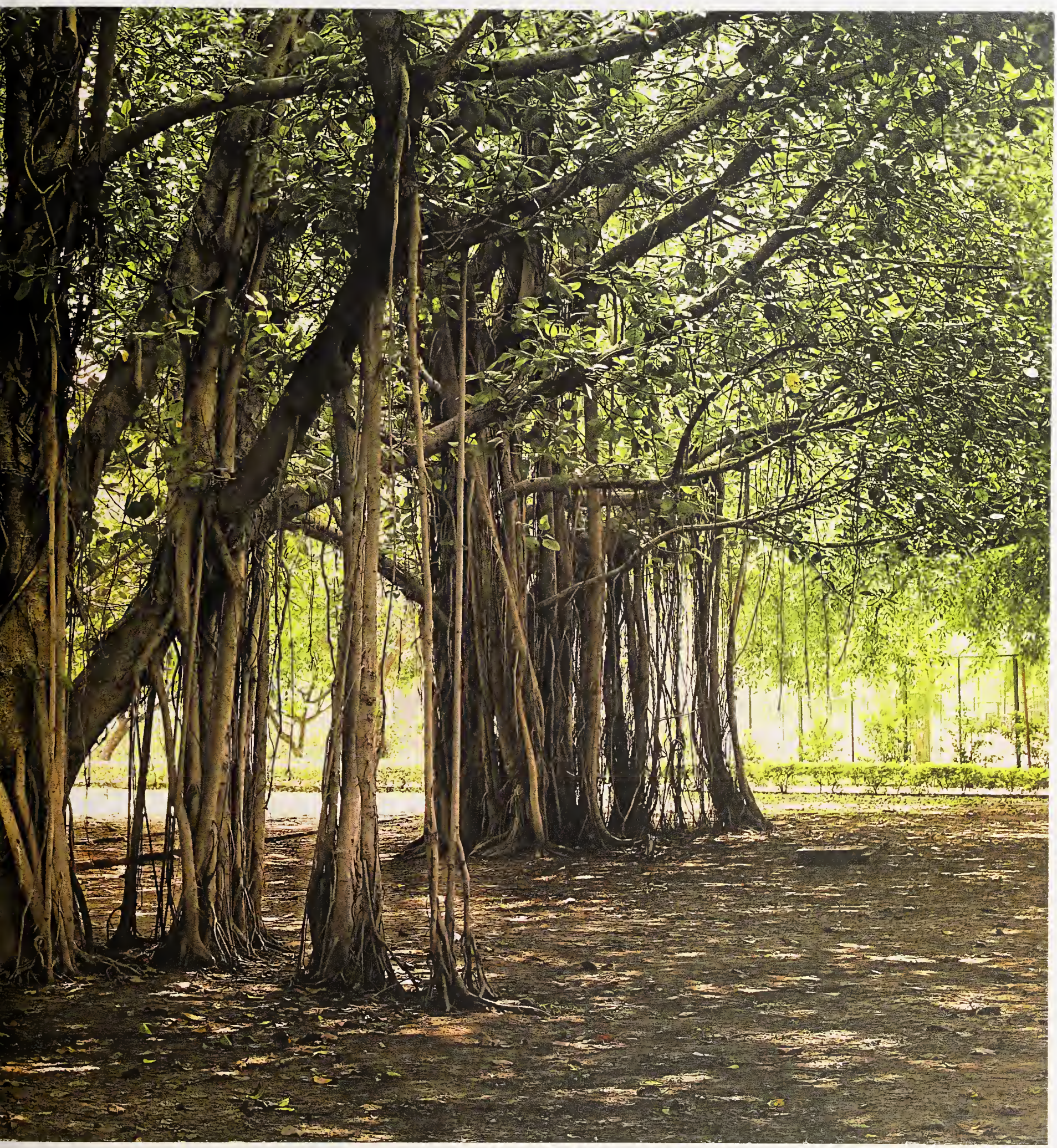
I have no difficulty in believing that the banyan, too, was a Mustoe-choice.

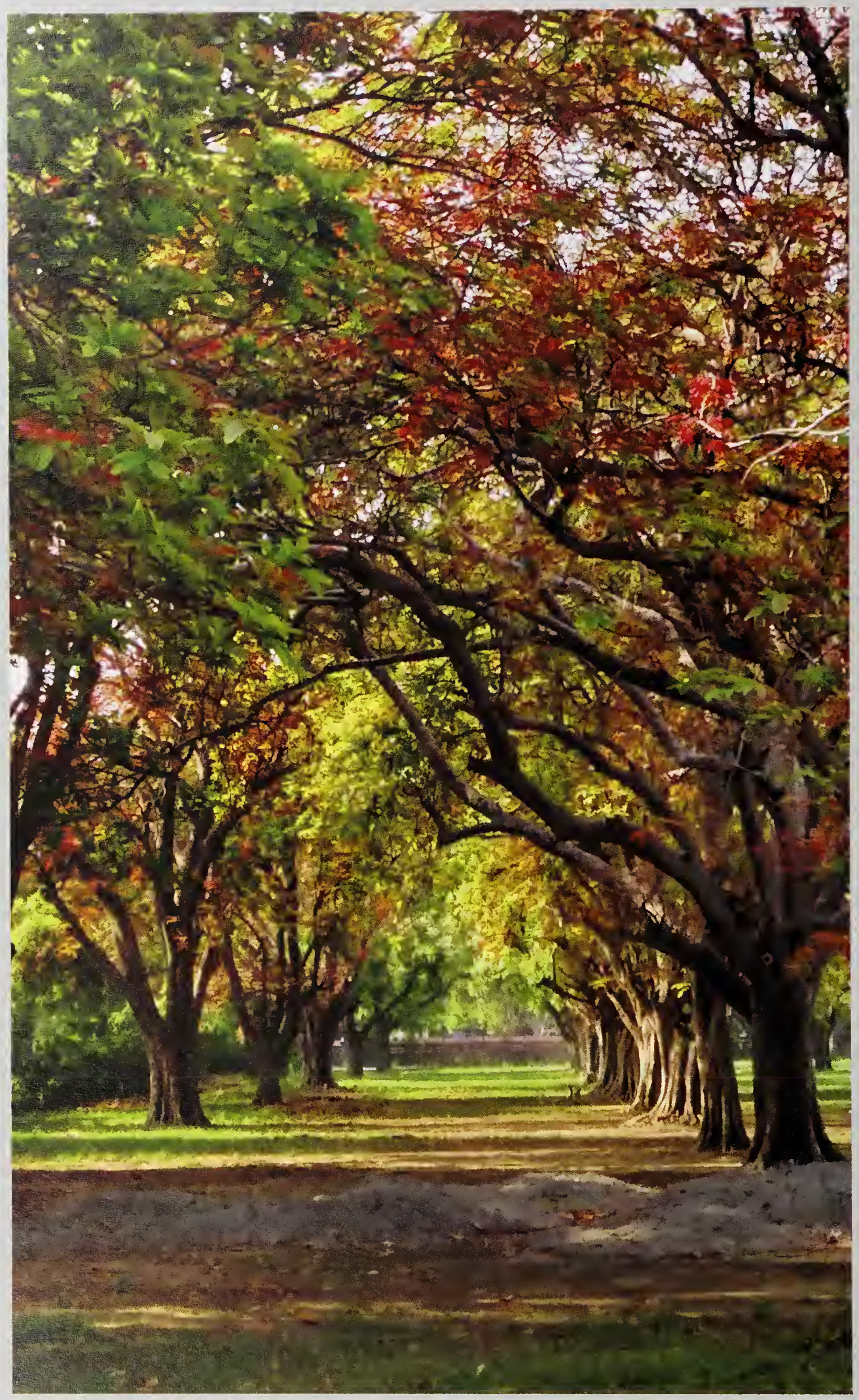




ABOVE:
Banyan figs

RIGHT:
The banyan would have been too big a temptation to resist for a British horticulturist. Banyans do not make well-behaved avenue trees, but the Viceregal Estate would have been just the right scale for this enormous tree





KOSAM

THERE ARE TWO double rows of kosam trees in a southern area of the President's Estate, but curiously, there are no roads between the rows of trees so the planting seems a bit anomalous. Could there have been roads here that were later closed and allowed to be grown over? Were these roads that were planned but never built? Were they perhaps intended to be tree-lined promenades for strolling in?

I have no answers, but the choice of kosam to line avenues is interesting because this tree finds no place at all in New Delhi's scheme.[17]

Kosam is native to central Indian dry forests and to slightly more moist forests in the sub-Himalayan region. It is also found in the southern Deccan and Sri Lanka and wherever they grow, kosam trees alert you to their presence by producing young new leaves of the brightest red hue you can imagine. To me, it's always been surprising that landscape architects in India have not made more of kosams as bright, arresting show-stoppers in early spring, and as fairly cheerful trees at most other times. Of course the tree fails the 'evergreen test' so dear to British arboriculturists of an earlier time, which is perhaps why it never made it onto New Delhi's streets. Nevertheless, it is worth noting that this is one of the few avenue trees inside the Estate that is ecologically perfectly 'at home', comfortable in the soil and climate that New Delhi has to offer.

An inspired choice is my verdict. But a bit unlikely to be Mustoe's.

ABOVE:
Young Rhesus Macaques swinging from kosam branches

LEFT PAGE:
Kosam trees without an avenue
[Photo credit: Amita Baviskar]



ABOVE:
Flowers of the sausage tree hang down below the foliage to enable bats to visit them
[Photo credit: Brinda Datta]

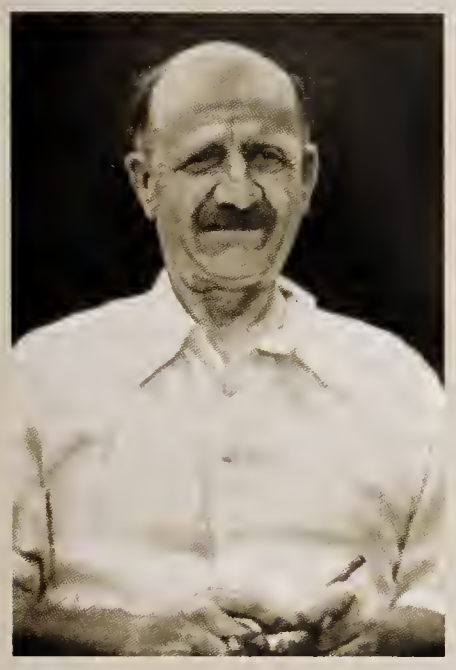
SAUSAGE TREE

IT'S NOT AT ALL clear when this central African tree (from Mozambique, Zimbabwe and other parts of semi-moist tropical Africa), with enormously long stalks to its flowers and fruit, made it across to India. My guess is: some time in the mid-nineteenth century, possibly earlier. We find it planted in Lahore quite early on, and it is still among the last trees standing in parts of Delhi's Walled City where trees from the late nineteenth century endure.

At some point, the sausage tree was co-opted as a desirable exotic and began to be planted in parks and gardens.[18] And in the specially wrought scheme for New Delhi's avenues, it was provided a niche of its own, not just in the area around Gol Dak Khana, but along a complex of roads in the Khan Market area and on the North and South Avenues as well. This qualifies the sausage tree to rank among the mainline species of New Delhi's scheme, and it is the *only* tree from this select class that is seen on the Estate's avenues today.

Here (again), it is puzzling why the sausage tree was chosen. Its ecological suitability is questionable: in its natural habitat, the sausage tree grows in open woodland and not-too-dry savannah, requiring deep, well-drained soil and a fair amount of rain. Where it does survive in drier areas, it does so only along the banks of perennial streams, where it lines up in 'gallery forests'. Delhi hardly seems to match up to its natural habitat. Yet it seems to get on quite well here.

THE AVENUE TREE SCHEME MYSTERY



SO WAS MUSTOE the author of the tree scheme for the Viceroy's House? What do we make of a tree scheme that bears only a few of the hallmarks of its putative author?

One line of reasoning could be that Mustoe was impelled to 'do something very different' for the grandest piece of real estate in India. Do we know anything of the trees which Mustoe thought most highly of? There are lists in his Punjab *Notes*, and though, of course, he could have changed his mind or outgrown some of them, it is clear that there is little in common between the trees that figure prominently in his *Notes* and the ones he (is thought to have) planted in the Viceregal Estate.[1]

Soon after he arrived in New Delhi, Mustoe was handed over charge of the dilapidated Talkatora Gardens, separated from the Viceregal Estate only by the width of a road. Here he raised several species that he thought might be ideal for New Delhi's streets, besides several others he hoped or guessed might do well in Delhi.

Talkatora Gardens are much truncated and fiddled about with now, but even if you go there today, nearly a century on, you can still see a few trees that stand out as unique or rare in Delhi — kakkar, khirk, tun, bishopwood and Spanish mahogany. They are all likely to be relics of Mustoe's 'experiments'.

Wouldn't you expect that Mustoe would have chosen some of these unusual trees for his grandest assignment of all? Well, he didn't. Maybe there wasn't enough time for these trees to prove themselves.

On a totally different tack, is it possible that the trees that Mustoe planted haven't survived inside the President's Estate, and that what we see there today is the work of later horticulturists? I don't think this is so. It is true that there are breaks and aberrations in some of the avenue tree lineaments. But an older, original scheme is still discernible, albeit somewhat ragged in places.

There is, finally, the possibility that Mustoe was not, after all, the author of the avenue scheme for the Viceregal Estate. We know that the provisioning of the formal gardens with 'English flowers' would have consumed an inordinate amount of his time and energy, so is it not conceivable that when it came to planting up the extensive parkland beyond, Mustoe simply delegated the job to lesser mortals? I find this unlikely even while insisting that it is difficult to reconcile the surviving scheme with Mustoe's 'style'.

We may just have to accept this matter of authorship as an intriguing puzzle. Maybe something will turn up in the archival record one day that will put the matter to rest.

In the meantime, does it *really* matter whether Mustoe chose these trees or not?

I believe it matters if one can *trust* that a grand scheme emanates from someone who really knew what he was doing. If Mustoe was the maestro who selected New Delhi's avenue trees a hundred years ago, it *matters* because it is a scheme we have grown to admire, and that has in most ways stood the test of time.

The same cannot be said of the President's Estate's avenue trees. Its tree scheme is at best patchy and anomalous, with many trees of dubious aesthetic value and ecological suitability. Every intervention that has been made by the present custodians of the Estate's horticulture — the Central Public Works Department — to keep up or bolster the avenue plantation, has served only to debase or muddy the scheme.

It might seem non-intuitive, but it would be useful to arrive at the conclusion that the Great Estate's avenue tree schemes have not been well thought out. It might therefore be opportune to seize this moment to re-think the Estate's avenue tree schemes in order to create something new and truly wonderful. Something grand that befits a Great Estate.

ABOVE:
Illustration based on a photograph of Mustoe from his obituary in the *Journal of the Kew Guild* (1942)
[Illustration credit: Shekhar Gurera]

THE WILD SIDE OF THE VICEREGAL ESTATE

IF YOU LOOK at the Rashtrapati Bhavan on Google Earth, you will see that the Estate sits at a junction of the Central Ridge forest to the west with the arable *bangar* habitat which begins here and continues east towards the river. The forest canopy looks unbroken as it vaults across Mother Teresa Crescent into the Estate, petering out eventually into smallish pockets of unruly woodland and scrub inside.

Was this something that Lutyens *intended* — to have the Ridge forest merge into the Estate to present an unbroken vista of wilderness? This is not an ambition that should surprise us. It is very much of a piece with the way in which manorial estates were conceived in England at that time. But can we surmise that this is what Lutyens might have wanted to do? After all an English woodland is very different from a scrub forest.

To answer this question we need to know what the Ridge forest might have been like in the 1920s and '30s when the viceregal grounds were being planned and created. And how Lutyens might have *imagined* the Ridge forest to look like a few decades later, because this would surely have mattered to his plans.

A report of the Town Planning Committee (which included Lutyens) in 1912–13 described the Ridge as an empty, rocky, wasteland:

> ... At present the ridge is heavily grazed by numerous flocks of goats and sheep, and vegetation has little chance of successful existence ... A scheme has now been drawn up by an experienced forest officer for the afforestation of the ridge ... It is anticipated that the stoppage of browsing will in itself conduce to the rapid growth of much natural wild vegetation, while



RIGHT:
Google Earth image showing the continuity between the Central Ridge and the jungle patches on the President's Estate

1. Forecourt
2. Rashtrapati Bhavan
3. Mughal Garden
4. Golf course
5. Dalikhana
6. Jungle patches
7. Mother Teresa Crescent
8. Central Ridge
9. Polo ground
10. Vijay Chowk



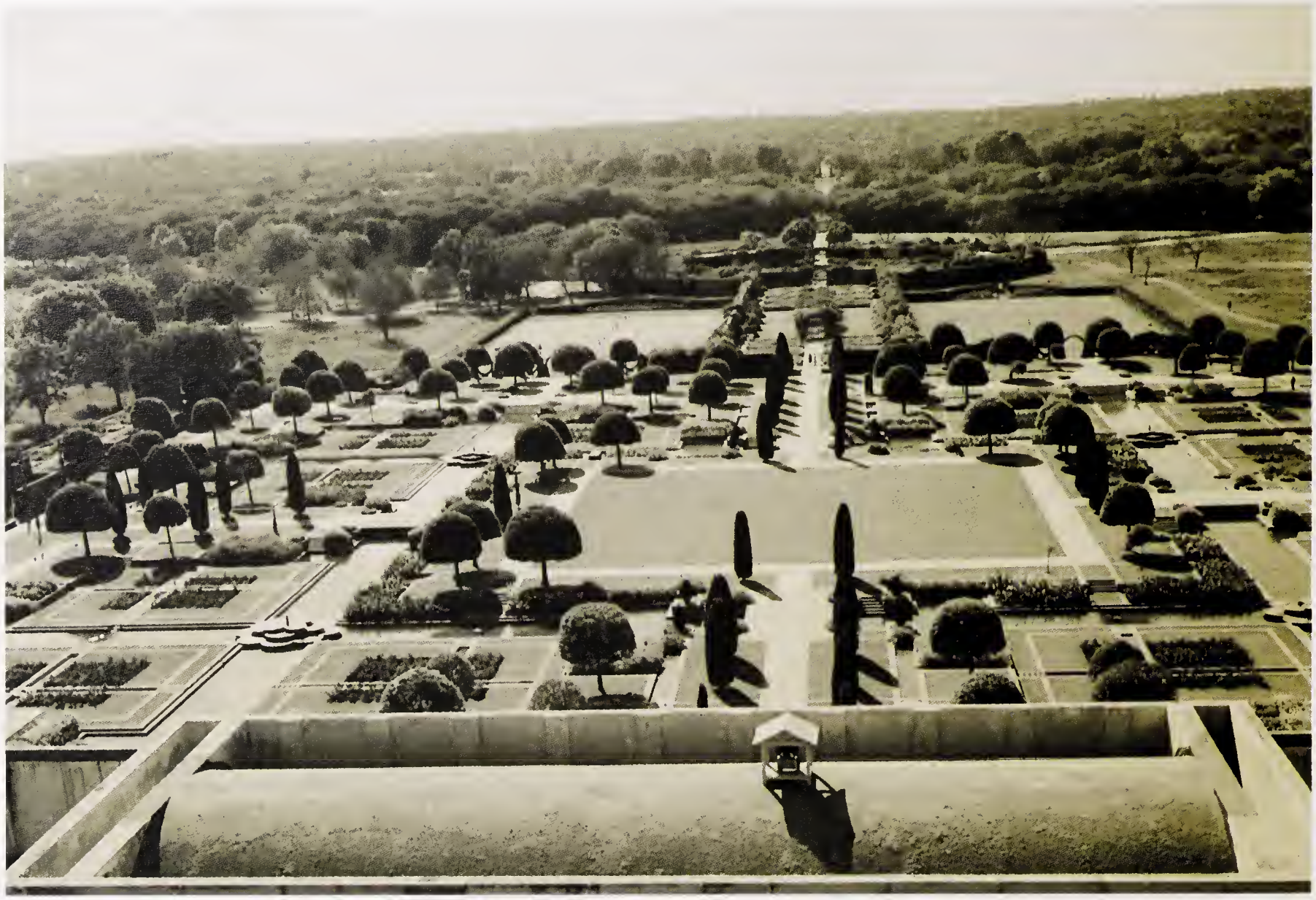
> the skilled arboricultural operations of the afforestation scheme will result in a complete reboisement of these hills ...[20]

This section of Delhi's Ridge first swam into focus when the Imperial Capital Committee and Viceroy Hardinge locked horns over where to locate the Viceregal Palace and how to orient the great processional thoroughfare (Kingsway, later Rajpath) that led down and away from it. The first suggestion — at the base of Raisina Hill — was rejected because Kingsway would then have led north-east towards the Jama Masjid and would have entailed the appropriation and dismantling of Paharganj. Hardinge bridled at the expense and asked the committee to go back to its drawing board.

In the rains of 1912, while members of the committee were still in England, Hardinge travelled on horseback to look at an alternative location on the highest eminence of the Ridge (behind Talkatora) and wrote excitedly to Lutyens in England:

> Can you imagine how splendid a white Government House with red tiles and a gilt dome would look in such a commanding situation, dominating the whole of the country round, while the slope from the situation of Government House down to the plain would be covered with terraces and fountains like a miniature Versailles?
>
> ... The whole question of the lay-out wants reconsideration. I have at the present moment the most capable Forest officer I could find examining the question of the afforestation of

ABOVE:
The Rashtrapati Bhavan seen from an eminence in the Central Ridge [Photo credit: Pradip Krishen]



ABOVE:
An early view from the roof of the Rashtrapati Bhavan showing the formal gardens and the Ridge beyond
[Source: Publications Division, Government of India]

> the Ridge above Talkatora.[21] If it is possible to plant the Ridge at moderate expense, which most Forest experts here consider feasible, it is perfectly obvious to me that the only site for Government House is on the Ridge above Talkatora, commanding the most lovely views over the city of Delhi and over the whole plain, both east and west.[22]

Not long after, Hardinge was persuaded to give up his eyrie on the Ridge (in favour of a decapitated Raisina Hill) but one of the collateral effects of this story was that a degraded, neglected expanse of the rocky Ridge was dragged into the spotlight and infused with the prospect of revival.

It began in a small way and, before the end of 1913, the long, curving arm of the Ridge that nudged the Viceregal Estate was fenced off and closed to grazing.[23] In August 1914, all of what is now called the 'Central Ridge' was notified as Reserved Forest. R.N. Parker, a forester visiting from the Punjab, tells us it was still bare at this time with 'practically nothing that had not been cut and browsed down to a few inches', but afforestation plans were afoot and already by the cold weather of 1918–19, 'trees and shrubs had sprung up from roots left in the ground and in places form thickets it would be difficult to get through'.[24]

We know quite a lot about early, fitful efforts to afforest the Central Ridge. We won't follow that story in detail but it is mostly a sorry tale of planting inappropriate species that had little chance of surviving once watering was withdrawn. Protection helped some of the original wild rootstock to regenerate but trees like karanj, shisham, kachnar, tun, putranjiva and arjun are adapted to much more moist conditions and deeper soil, and did not for those reasons stand a chance on the Ridge.

Forester Parker re-visited the Central Ridge in

1935, 16 years after he wrote his first report, to find that most of the work done in the intervening years had been wasted. The authorities had persisted with planting unsuitable species which struggled in dry, rocky soil. 'Native' trees turned out to be not-so-native after all. Of everything that had been planted there, one tree alone had flourished — a hardy mimosa from central and southern America called *Prosopis juliflora* or 'mesquite' ('vilaiti keekar' in Delhi). Sooner than anyone realised, vilaiti keekar was to become the scourge of New Delhi, vigorously outcompeting everything else by dint of its reproductive vigour and an arsenal of deterrent alkaloids in its root zone, until the whole of the Ridge — and considerably beyond — became a bleak monoculture of this invasive tree. We still live with the legacy of this unwise introduction.

Mustoe was part of this story and threw himself energetically into the task of planting up the Ridge after he arrived in Delhi in 1919. Walter George claims it was Mustoe who searched for and first introduced vilaiti keekar as the wonder tree that would redeem the Ridge,[25] but this tree was already in use in India and indeed, on the Ridge, so Mustoe was probably not so much the first one to plant it but its most enthusiastic proponent for the Ridge.[26]

In Walter George's account:

> With this [vilaiti keekar], and without asking for any big estimate, he [Mustoe] reafforested the Ridge. He went out in his old car on a Sunday. I have sometimes gone with him taking a few coolies with crow-bars, pick-axes, etc.; he would walk over an area, and then say, 'Loosen that crack a bit for me' or 'Dig a little here', and he would then put in his seeds. Gradually the Ridge has been covered with Prosopis; when it had become established, better things were planted. It has spread all over the State and it could help to redeem even the Rajputana desert if properly handled.[27]

By the close of the 1920s when construction on the Viceregal Estate was nearing completion, this part of the Ridge — the eastern end abutting Cantonment Road (later, Willingdon Crescent; most recently Mother Teresa Crescent) — now approximated a forest. Wild animals thought so too. A total of 160 porcupines were trapped and killed here in the winter of 1926–27.[28] Viceroy Willingdon went out shooting on the Ridge (even though it was prohibited) just



LEFT:
Vilaiti keekar has muscled its way into the jungle patches in the Estate and resists eviction

a few years later and his party bagged 30 partridges and 13 hares.[29]A jackal eluded the party, but it was the beginning of a long campaign by New Delhi's Municipal Committee to rid the Central Ridge of jackals 'as [their Excellencies] really were disturbed nearly every night by the noise of jackals howling in the Viceregal Estate'.[30]

So we learn that Lutyens and Mustoe did in fact see a wilderness taking shape in the western extremity of the Viceregal Estate and were able therefore to incorporate a patch of wilderness into their plans. The ridgey swathes were very likely quite different then — it would take more time, another 20 years or so, for vilaiti keekar to establish its dominance of the canopy enough to engulf the original wild species, which means that Lutyens probably saw a prettier, more diverse version of the Ridge forest than we see there today. In any event, we are able to say with confidence that by the late 1920s, the wilderness to the west of the Viceregal Estate offered Lutyens a pleasing vista and a continuum with the forest behind that he was able happily to incorporate into his plan. Far from being a peripheral inclusion, as one might have surmised, the woodland was an integral part of the 'effect' that Lutyens desired for his plans.

In the end, Lutyens's plan for the grounds of the Viceregal Estate begins to look like it came straight out of classical English country landscape: stately home in the middle, fronted by a red gravel drive; parkland and grassy glades all around dotted with spreading trees, shading into distant woodland. I don't know if Lutyens visited Calcutta and Barrackpore, but it is tempting to wonder if his landscape plans were influenced by Belvedere House, the Governor General's nineteenth-century residence in Calcutta, and his upcountry home in Barrackpore.[31]



RIGHT:
The Governor General's estate in Barrackpore, Bengal, while a classic stately home and park, saw a few attempts to create native jungles in the nineteenth century [Photo credit: Samuel Bourne /The Alkazi Collection of Photography]

THE ESTATE'S RELICT FOREST

THE PRESIDENT'S ESTATE has lost a fair portion of its semi-wilderness. It's not clear when exactly this might have happened but it's a fair guess that the forest has been gradually whittled away by attrition over the last 40 or 50 years. You can still see relict patches of scrubby forest here and there but significant swathes have been cleared or 'tamed'.

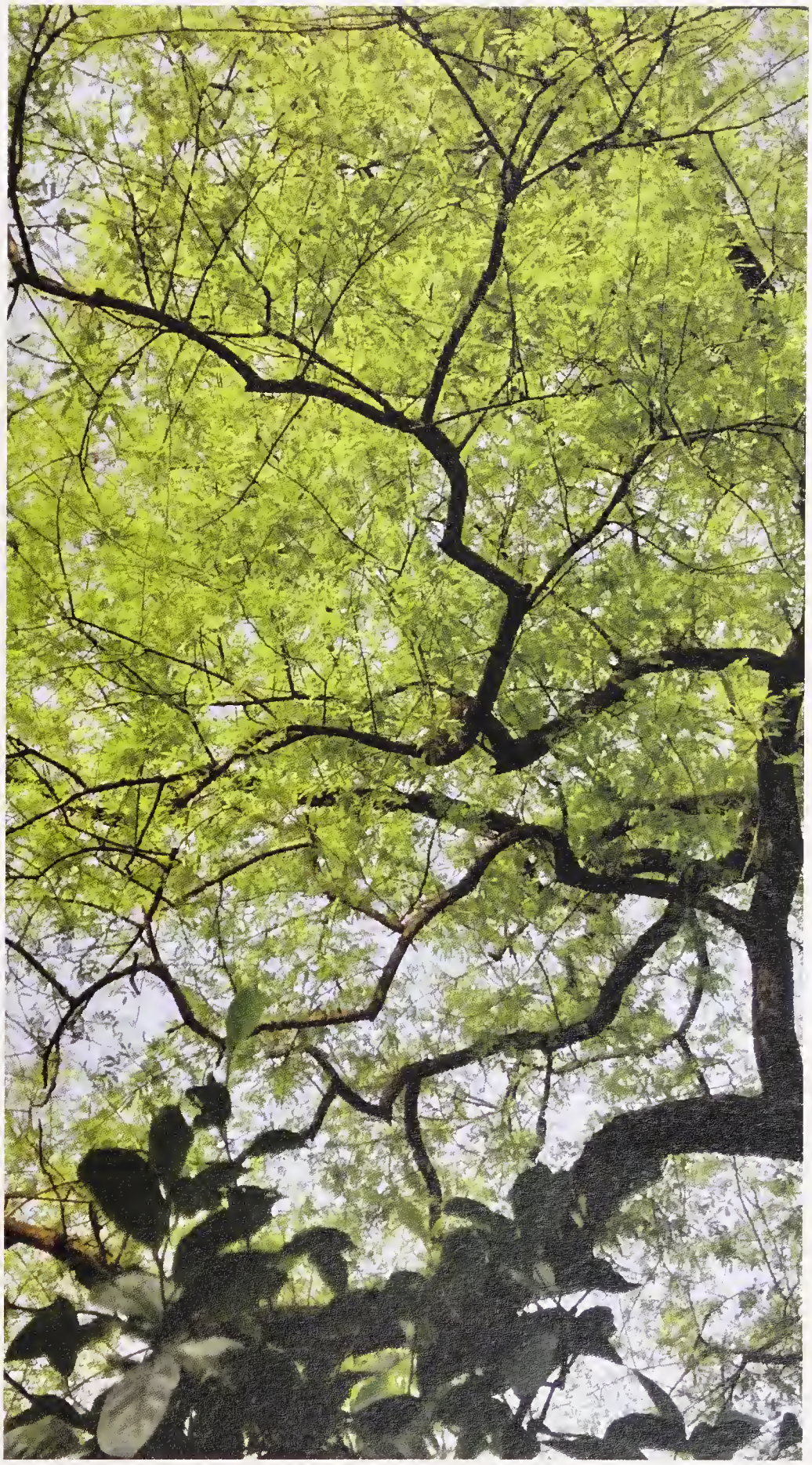
It's probably no surprise that whenever a President or a President's spouse has asked for a new feature in the garden — such as President Kalam's peculiar 'Spiritual Garden' — the axe has always fallen on a patch of 'forest'. This is because the forest is not valued in itself, is regarded as dispensable, and this has to do with the fact that the character of the forest has changed for the worse (with vilaiti keekar taking over to the extent it has).

There are five wild trees still seen inside the President's Estate that need to be known better:

SON KHAIR

I came across a small clutch of these southern acacias in two patches of forest inside the Estate and it took a little effort to recognise them because they are not previously recorded from Delhi. It is possible that they are forgotten remnants of an earlier afforestation scheme from the 1930s or perhaps a little later.

Son khair are mid-sized, deciduous mimosas from dry thorn forests in the southern peninsula, with Maharashtra and Gujarat as their natural northern limit. The common name in English — 'rusty acacia' — has stuck, but their most distinctive character is their dark, flaky, fissured bark, quite different from anything else growing around them here. They come into pale new leaf and look quite pretty when they flower early in the rains, but it is because they are the only trees of their kind in Delhi that marks them out as special.



ABOVE: Son khair in fresh new leaf in June [Photo credit: Amita Baviskar]



RIGHT:
Although superbly adapted to dry, stony hills, kumttha has become scarce in Delhi

BELOW:
Kumttha puts out its pipe-cleaner flowers in profusion



KUMTTHA

Kumttha is a small, thorny acacia from extremely dry, rocky hillsides, associated more with the arid reaches of the western desert than the Delhi sub-region. It is found naturally here in the quartzite hills of the Aravallis and the trees on the President's Estate may well be unplanted.

Kumttha has three distinctive features — pale yellow, papery bark and masses of 'pipe-cleaner' flowers that adorn the tree extravagantly in the rains. It is the only mimosa in Delhi with spines clustered in threes.

There's a prominent spreading kumttha perched on a low embankment near the auditorium that looks resplendent in new leaf and in flower, and there are more specimens hidden inside the ridgy bits of forest that still endure.

CHAMROD

Chamrod is a smallish tree from dry forests in north and central India and is fairly common on the Ridge in Delhi. It has one remarkable trait that is worth mentioning: between January and the start of the rainy season, every time it rains, chamrod responds by putting out masses of little, white, star-shaped flowers. This is not how most trees behave, because flowering is usually set into train by regular environmental cues such as rising temperature or the lengthening of daylight. It is still a bit of a mystery *exactly* how chamrod does this, because there are no signs of incipient buds on the tree. And yet, barely a day or two after a sudden unseasonal downpour, chamrod will be festooned with new flowers!

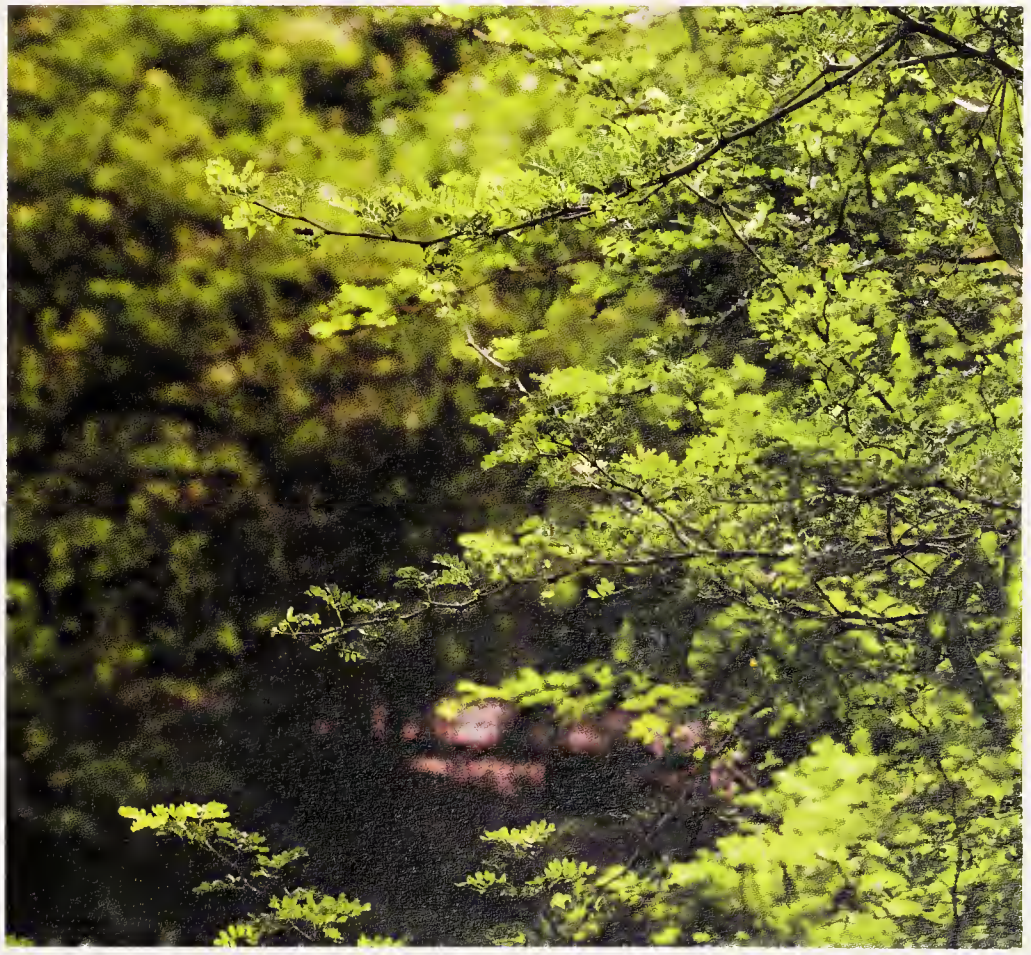
I haven't found chamrod cultivated anywhere, so it is a bit of a surprise to find one tree growing prominently inside the President's Estate. Of course there are plenty of these trees inside the wild bits of forest on the Estate.



PHULAI

Phulai is another small, deciduous acacia, a particularly hardy tree that thrives in dry, stony hills north and, for a considerable expanse, west and north-west of Delhi. In late nineteenth century gardening manuals, phulai was recommended as the ideal hedge plant for the Punjab (Delhi was a district of the Punjab until 1911), not just because it was impenetrably thorny and strong, but because it was so pretty. We have all but forgotten about its existence in Delhi and it is not seen in cultivation anywhere that I have looked.

Phulai was planted on the Central and Northern Ridge and survives in a few relict patches, and it is heartening to see it clinging on inside the Estate. It is not an imposing tree, by any means, but it has the prettiest leaflets of any acacia I've seen — broad, nearly oval, small and delicate. It looks particularly lovely in the month of June when it is in new leaf.



ABOVE: Chamrod flowers [Photo credit: Pradip Krishen]

BELOW: Tender pods and leaves on the phulai in summer

BISTENDU

Bistendu is very special because it is the *only* native Delhi tree that was planted for ornament by British horticulturists in the new capital, most probably around the 1930s.

In natural conditions, bistendu is a short tree with an immense, spreading canopy and is deciduous, like nearly all of Delhi's native trees. It was planted and pruned into elongated egg-shapes on the lawns of Vijay Chowk (formerly the 'Great Place' at the base of the Secretariat acropolis) and here, because the lawns are watered regularly, bistendu behaves like a box-hedge, evergreen and coppicing frantically.

On the President's Estate, there are a few strikingly handsome bistendu trees at the edge of the forest and many more hidden from sight inside. Its foliage has a happy way of looking lovely even in May and June when it is hot and dry, and female trees are eye-catching when their berries are ripening orangey-yellow, like plump kumquats.



BELOW:
A young bistendu growing at the edge of a jungle patch near the golf course

It is no surprise that a large estate like the Rashtrapati Bhavan's has changed a lot since it was first planted up. Time and happenstance take their toll. Some ideas and schemes don't quite work out as they were intended to. Some trees may not have adapted or 'behaved' in ways they were expected to. None of this is unusual or surprising. The real pity is that we haven't found the means to remedy these outcomes.

The question that faces the custodians of the Estate's grounds is how to take this forward, not just with good common sense but a touch of inspiration and ambitious intent, too. One way is to try and reach back into history and restore the gardens as best they can, trying to divine the original intention and sticking to it with unswerving constancy. I believe this would be a mistake.

I have tried to show that there are flaws in the original design and conception of the tree planting. The khirnis have disappointed. The karanj trees have not served the Estate well. The forest swathes have become 'polluted' with the South American invasive tree and have dwindled into insignificant patches. More worryingly, the CPWD has lowered the tone of the planting with nearly every single intervention it has made.

We have a wonderful opportunity today to undo some of these mistakes and create a new plan that is every bit as grand as the conception that Lutyens brought to the buildings. The gardens and grounds need curating and imaginative planning in the light of all we have learned in the last 90 years or so. It is an important juncture in the life of the President's Estate and an opportunity that ought to be grasped with both hands.



NOTABLE TREES ON THE PRESIDENT'S ESTATE

If you walk around the grounds of the President's Estate you are likely to run into a few trees that will catch your eye because they are uncommon in Delhi and, if you are luckier still and happen to see them at just the right time of year, you could be in for a treat!

Here are a few of them in pictures. Shisham, of course, is by no means uncommon, but it makes the cut simply because this one is such a huge, gnarled specimen, full of mystery and character.

SITA ASHOK

This is not a tree that likes Delhi's dry climate but when it's planted right — in relatively cool, shady places — you can see why the sita ashok is often billed as India's *most* beautiful flowering tree. The tight clusters of flowers start out apricot yellow, changing slowly on exposure from orange to bright scarlet. Note that the colour is provided entirely by the sepals — the sita ashok has no petals at all! Also, that the flowers emerge directly from 'old wood', such as the main trunk of the tree.

SHISHAM

This lovely old shisham specimen probably goes back to when the grounds of the Viceroy's House were first planted up in the early 1930s. Shisham (*taali* in Punjabi) is found naturally in a broad, moist belt of the sub-Himalayan tracts where rivers bottom out and deposit their load of fine mountain silt. Classic shisham country is wet and deep and richly loamy-alluvial, which is why you cannot reasonably expect it to grow happily on the Ridge.







GAB

This is a tree you probably wouldn't notice unless you came upon it in March when it puts out new leaves in a startling shade of crimson. Gab is an evergreen tree from moist regions of Bengal and the eastern seaboard (and further east, across the seas) which is why the crimson is limited to the very tips of its branches, the only part of this tree where it adds new growth. Scientists think the red of tropical new leaves makes them invisible to insect predators, who can't see at all in the long wavelengths or the red end of the spectrum.

GOURD TREE

The dingy but arresting flowers of this Central American tree grow directly from its trunk, opening at night to lure small bats with their musty perfume. This picture shows the outsides of two bell-shaped flowers, with petals ending in intense wrinkly frills. The bright yellow belongs to the receptacles of flowers that have been fertilised and have shed their petals and stamens. It is also called the ‘calabash tree’ because of its hard-shelled, gourd-like fruit.





LEMON-SCENTED GUM

This tree was just one of over 650 species of Australian *Eucalyptus* trees and shrubs until 1995 when scientists created a new genus of 32 plants that they renamed *Corymbia*. The lemon-scented gum has been around in India for a long time, one of only half a dozen or so 'gum trees' that successfully made the crossing from Australia. Best known for its ivory-smooth bark and, of course, its citrus-smelling leaves, it grows to 15m in India — a midget compared to the 40m it is reported to reach in its native forests of north-eastern Australia.

[Photo credit: Pradip Krishen]

WILD ALMOND

Also called 'Indian almond', this is neither uniquely Indian nor a true almond, and you could be forgiven for mistaking it for a semal or red silk cotton tree, but in any event, chances are you will be struck by its stately form and its curious red, boat-shaped fruit follicles.

This is a coastal tree from southern India and Sri Lanka whose natural range extends across the seas to monsoon and intermediate forests in Myanmar, South-east Asia and north Australia. Its flowers have a putrid smell but the woody fruit open to release the seeds and dry in the shape of toy hearts that are worth presenting as gestures of love.

[Photo credit: Amita Baviskar]







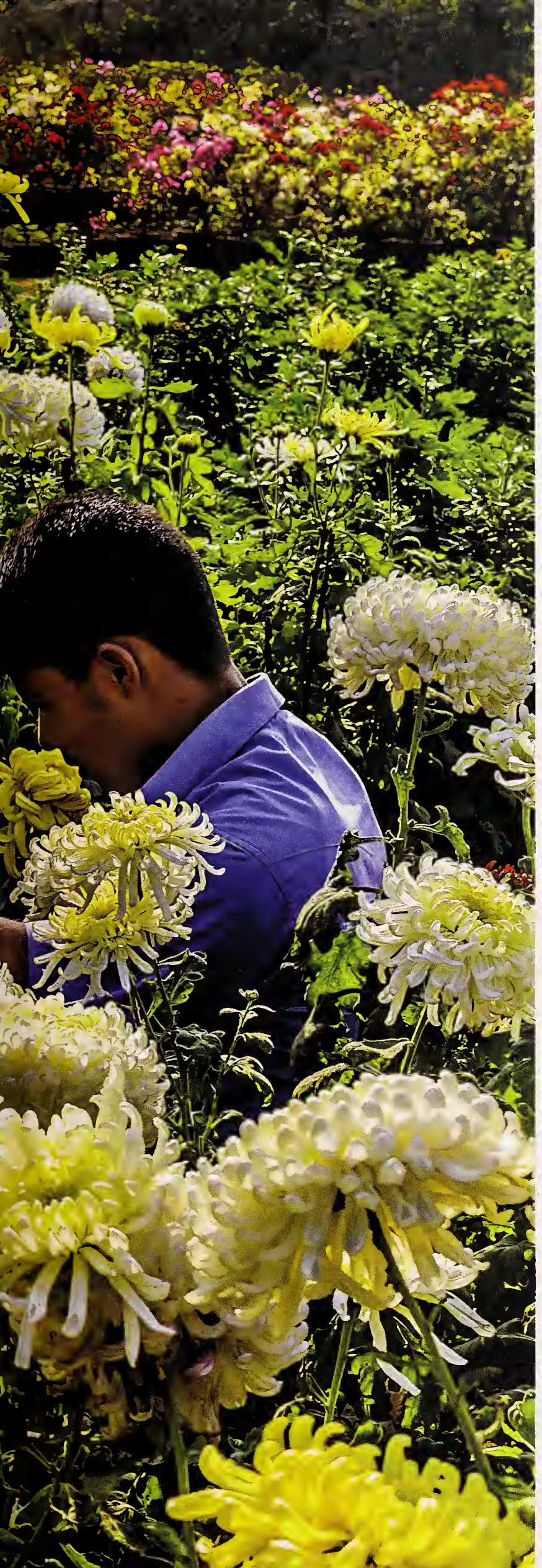


DOON SIRIS

It is called the ‘white siris’, ‘tall albizia’, the ‘black siris’ and the ‘forest siris’ but it is the name ‘Doon siris’ alone that captures a sense of its favoured habitat in sheltered valleys in the sub-Himalayan tract. It is the most moisture loving of all the Albizias which is probably why it struggles in Delhi. Even in stunted form, it makes a handsome tree with its pale bark and dark red blister-pack pods.

ABOVE: [Photo credit: Pradip Krishen]





chapter four

Backstage

GARDENERS AT WORK

AMITA BAVISKAR

Bechanram, Garden Chaudhari, was worried.[1] The monsoon had been unusually heavy this year and had continued into September. Now, even in early December, the weather still wasn't cold enough. Many of the calendula, phlox and dianthus seeds that they had sowed didn't germinate and the seedlings that did emerge were puny and straggly. The heavy smog that blocked out the sun hadn't helped either. They would have to sow again, praying that the new lot of seeds would sprout properly, but then the plants would be late in flowering and the garden had to be in bloom by 26 January. They could buy seedlings from outside — they had reliable suppliers in Kolkata who could provide healthy plants — but one never knew exactly how they would turn out: the colour, the height — any unexpected feature and the effect that they were planning for in the Mughal Garden would be ruined. That's why the seeds they collected themselves from the previous year's flowers were the best: they knew exactly what they would grow into. But this weather had upset every calculation. It would be a poorer display this year. Casual visitors might not notice the difference for there would still be plenty to admire. But those who really knew the garden, as did its malis, would look at each other and shake their heads ruefully.

Every gardener learns to be stoic about what the weather brings. But when the garden that one grows is the most famous one in the country, each unlooked for turn in temperature is a matter of major concern. From September onwards, 65 malis are on their mettle, meticulously going through each intricately choreographed step leading to the garden's grand opening on Republic Day. Any fumble or false step during these five months would be publicly visible. With so much at stake, it is no wonder that the senior malis are a little brusque with the interviewer, while their supervising officer bites his lip while looking over the calendar that details the duties for each day.

Work on the formal gardens begins in earnest in September. Before that, in April and May, workers remove the previous winter's spent annuals after carefully harvesting their seeds. After feeding the soil with manure, the beds are planted with staples that can take the blast of summer heat. First, early-ending annuals like dahlia are replaced with slow-growing canna that will only start to flower in July; later, beds of phlox and petunia that continue to flower into May are replenished with sunflower, cosmos, rosy periwinkle and zinnia. The grass is shaved down to its roots and a layer of soil removed from the bald patches to encourage new growth. For the malis, summer is a more relaxed time: the garden merely has to be kept ticking over and, between watering the plants twice a day, they can catch up on other chores, go home for lunch and snooze in the afternoon. When the monsoon brings a fresh spurt of growth to all things green, their main task is tidying up: keeping the maulsari trees trimmed, weeding the flowerbeds and lawn, keeping the creepers in shape and controlling pests that infest the rose bushes.

With the retreat of the monsoon comes the busy season. Summer plants are uprooted and taken to the compost heap. The flowerbeds are dug up, their soil aerated and sunned to kill lurking fungi and unfriendly microbes. The lawn is weeded and mowed twice a week and fed a fortifying diet of urea, bone meal and herbal pest repellents. Late rains can foster termite and fungus infestation, so the ground may also have to be treated with more heavy-duty pesticides. The orange trees are pruned to encourage flowering and fruiting; the maulsari is given its signature bowl-shaped *katora*-cut, as the malis call it.

Meanwhile, in his office behind the Long Garden, P.N. Joshi, Section Officer in the Rashtrapati Bhavan's Horticulture Department, pulls out the previous year's *nakshaa* (map) or planting plan for the formal gardens and summons Sudarshan Kumar, Head Mali. Kumar's colleagues affectionately call him 'Doctor saab' because he can work with pen and paper in a way that they can't, delineating the entire floral scheme for the gardens. Other malis can also conceive planting schemes and discuss what should be grown, where and why, but they aren't used to putting their ideas



RIGHT
Leaf mould being sieved

RIGHT PAGE:
Keeping chrysanthemums from the cold



down formally. The paper plan is needed to get senior officials' approval and to set in motion the process of ordering a host of supplies: seeds, bulbs, plants, fertilisers and pesticides, tools and equipment, pots and what are called 'other consumables'— burlap, bamboo sticks, polythene sheets and such sundries. Ensuring that supplies and workers are available on time is the responsibility of U.D. Kukreti, the Horticultural Officer on Special Duty, and he is on the phone with the Security Department making sure that all the daily wage labourers contracted to work in the gardens are cleared for entry into the Estate. Files and piles of paperwork flow in and out of his office.

Much of the preparation for the winter performance of the formal gardens happens backstage in the Dalikhana. In November, this usually sleepy utility area is abuzz from dawn to dusk. More than a dozen workers toil away in a corner of the expansive grounds sieving leaf mould from the gigantic compost heap accumulated from the previous year. This is mixed with home-made vermicompost or with manure from the Okhla sewage plant, bone meal and neem oil-cake to make a super-food that fuels strong growth and vigorous flowering in plants. Now the seedbeds at the entrance to the Dalikhana are filled with inch-long sprouts of annuals of different kinds. Once they've grown a bit, they will be thinned and then transplanted into beds in the formal gardens.

Nearby, under the giant pilkhan tree, are arrayed hundreds of pots of chrysanthemums with tightly furled petals, waiting to unfold just before the YWCA flower show in the first week of December.[2] The trick to getting mums to flower on a precise date is to control the watering, but a cold snap can trigger buds to open. So to stop them jumping the gun they are swathed in polythene sheets to keep them warm. A couple of workers are painting the terracotta pots with a burnt sienna-coloured emulsion under the watchful eye of Senior Mali, Ram Pyare. Beyond them, a truck is being unloaded. Young rose plants with their root balls wrapped in straw have arrived from Punjab and will be used to replace dead and diseased rose bushes in the formal gardens, a process the malis call 'gap-filling'. Dahlia tubers and cuttings just delivered from Kolkata are also waiting to be planted in their designated beds.



ABOVE:
Roses need special care to grow in Delhi

Meanwhile, back in the formal gardens, the rose bushes are being hard pruned right back to their skeleton, their roots aerated and the plants fed with manure and special micronutrient supplements. Pruning roses requires extra expertise for it's easy to kill the plant. And if the new shoots and buds should experience a sudden night of frost, they blacken and die. If the air is damp, greenflies and other insects that love roses will swarm that much thicker, as will fungi, so the plants have to be sprayed regularly with pesticides. All in all, considering what it takes to grow roses in Delhi, their cultivation in the formal gardens is an act of courage, even bordering on foolhardiness now that the climate has become more uncertain.

It's easier to grow the bulbs and corms — tulip, iris, daffodil, oriental lily, hyacinth, gladiolus and narcissus. Most of them are procured from the floral-industrial complex in the Netherlands and are programmed to behave with clockwork precision. Even chance weather disruptions don't ruffle their petals much; they are engineered to respond with reassuring predictability. Tulip bulbs planted on 7 December are guaranteed to flower by 26 January. No wonder then that, despite their cost, flowering bulbs now play a bigger part in the formal gardens' floral repertoire.

Once the winter annuals are established in their beds, the weeks of late December and early January are spent in tending them. Besides the watering, young plants have to be watched for disease and pests. Side shoots and buds have to be pinched off in many plants so that all their energy is concentrated in one big bloom. Taller plants like the daisies, snapdragons and dahlias need to be supported with stakes; a group of workers squats in the sun in the Dalikhana making thousands of splints of bamboo for this purpose. The lawn is fed, mowed and rolled thrice a week. Then, if all goes well, the first flowers will appear in mid-January and the spectacle that lakhs of visitors line up for — the public viewing of the Mughal Garden — will unfold once again.





ABOVE:
Young rose bushes get their start in the Dalikhana before being transplanted to the formal gardens

LEFT: Making splints for staking up dahlias and other tall annuals



The lakhs of visitors who file through the formal gardens in the spring little know that months of painstaking planning and hard labour have gone into creating this floral spectacle. From the brown flowerbeds of September to the rainbow colours and scents of February, it is the malis whose quiet and unremitting work makes the garden glow









ABOVE:
Maintaining the golf fairways and greens is a non-stop task

RIGHT:
Mechanised tools have made jobs like weeding the pavements much easier

RIGHT PAGE:
The day starts at dawn for this mali mixing manure into the vegetable beds in the Dalikhana

THE DALIKHANA AND GROUNDS

ALTHOUGH THE formal gardens are the most important part of the Rashtrapati Bhavan's gardens and grounds, and their season shapes the annual work regimen of the malis, there is plenty of year-round work on the rest of the Estate. Avenue trees and shrubs have to be pruned and trimmed; lawns watered, fed and mowed; roadside verges weeded and tidied. When trees shed their leaves in springtime, dozens of workers are deployed around the grounds every day, their long-handled brooms sweeping up the scattered fall into piles to be carted away to the compost heap. These routine tasks, and those who perform them, usually go unnoticed by visitors and residents, but even a day's disruption in their doing would make the Estate look more unkempt and gone to seed.

Besides such general upkeep, year-round work is focused on the Dalikhana or the kitchen garden. Originally designed to supply the Viceroy's House with fresh fruit and vegetables, the area of the Dalikhana has been eaten into over the years to accommodate a now-defunct 'bio-fuel' plantation, a pond and, most recently, a sewage treatment plant. The rest of the land, however, still remains under orchards and short crops. After Independence, when the country faced severe food shortages, wheat and mustard were sown here in the spirit of the 'Grow More Food' campaign. But for the last 50 years, the garden has been used to grow a variety of vegetables, especially those liked by the presidential family in residence. For President Pranab Mukherjee, for instance, different kinds of leafy greens from his native Bengal have been planted along with bottle gourd and snake gourd, brinjal and lady's finger. In winter, the malis plant 'English' vegetables: cauliflower, cabbage and broccoli, different kinds of lettuce, carrots and red radish. The unfiltered water that is used for irrigating the crops contains unwanted seeds, so weeding is a never-ending task in the kitchen garden. Rows of workers crouch with their trowels, methodically inching their way furrow by furrow, turning each clod of earth to prise out the roots of stubborn weeds. Since they went organic ten years ago, the gardeners have to spend more time preparing and applying compost and natural pest repellents. Digging and hoeing, squatting and bending all day long, the work is physically demanding. As one mali said, '*Baarah maheene kamar seedhi nahin hoti*' (Our backs don't straighten 12 months of the year).[3]



Some of the physically taxing tasks have become lighter over the years because of machines. Tractors have replaced the bullocks that were used to plough the fields. Hauling heavy loads of flowerpots, manure and pruned branches takes much less effort now that there



are tractor-driven trolleys instead of horse carts and wheelbarrows. Recently, electric shears and leaf-blowers have been purchased. In particular, keeping the grass down is a lot easier because of mechanised mowers. Older malis remember when acres of grass all across the Estate had to be scythed by hand, '*Ekdum khoonam-khoon ho jaate thé haath*' (Our hands would become absolutely bloodied).[4]

Another change in the Dalikhana, one that is a little sad to see, is the decline of the orchards. Some of this may be due to the climate. The massive old jackfruit trees that grow in a handsome row near the pond are bare of fruit, but then they probably never produced much at the best of times since they prefer moister conditions. The malis seem to also have given up on the grapevines that grow behind them. And what is the point of nurturing trees to produce fruit when it's the monkeys that are going to enjoy them? Even with two full-time workers shooting off catapults all day long to chase the animals away, and with the occasional *langur-wala* pitching in,[5] it's the monkeys that get to eat the lion's share of the guava, litchi and loquat. So the malis seem to have decided to let most of the orchards go, still watering and feeding the trees, but not bothering with the more intensive pruning, spraying and other tasks that serious fruit-growing calls for.





ABOVE:
Fresh fruit and vegetables on the way to the President's kitchen

LEFT:
Spraying herbal pesticide on young cauliflower plants

LEFT PAGE ABOVE:
Citrus trees and lettuce beds bask in the winter sun

LEFT PAGE BELOW:
A langur guard goes off duty after scaring away Rhesus Macaque raiders
[Photo credit: Amita Baviskar]

BECOMING A MALI

HOW DOES ONE become a mali on the President's Estate? Unlike other gardeners employed by the Central Public Works Department who are moved around from place to place, the Rashtrapati Bhavan malis are not transferred. Indeed, far from leaving the Estate, many of them were born on it since their fathers — and often, grandfathers — were also employed as malis before them. Earlier, one could get a job if someone put in a good word: '*jaan-pehchaan se kaam ho jaata tha*' and, if a worker died while in service, his son would be employed 'on compassionate grounds'.[6] It was a feudal system and it ensured a close-knit continuity between different generations of gardeners, the older teaching the younger. Not only kinship but caste and village ties are also important: many of the older gardeners belong to the Saini community, traditional market-gardeners from Rajasthan. Others come from Azamgarh and Faizabad districts of Uttar Pradesh.

As Vinod Prakash Saini, Chaudhari in the formal gardens, said, '*Hum haath ke dastkaar hain*' (Our craft lies in our hands).[7] Gardening lore is passed on by watching and doing. A keen eye and constant practice hone the skills required to nurture plants: to know which seeds require what ideal conditions to germinate; to gently tamp down the soil around a seedling with the exact amount of pressure that removes air pockets without hurting its tender roots and stem; how to optimise the changing calculus of space and sun and shade; when to feed and water, when to prune and harvest; how to diagnose what's afflicting a sickly plant and to nurse it back to health. There are no manuals or training courses on the President's Estate, only years of apprenticeship working alongside

BELOW:
The bamboo screen-covered 'greenhouse' that rings the Circular Garden was photographed soon after construction in 1931
[Photo credit: Arthur Gill / RIBApix]





ABOVE:
Used for growing bonsai plants and palms, the greenhouse is unchanged even after 85 years

the more experienced malis. Gardeners do visit the annual fair at the Pusa Agricultural Research Institute where they get to see new vegetable varieties and farming equipment, but that's about it. They also glean information and techniques from experts on bonsai or cacti or roses who are occasionally brought in to advise on the Rashtrapati Bhavan collections. Last year, some of the 'decoration malis' who arrange flowers for the Rashtrapati Bhavan were taken to a luxury hotel to learn new styles from professional florists. These initiatives have to be built upon to create a systematic process of reflecting on past and present gardening practices and incorporating new ideas and techniques.

A future challenge for the gardens is to fill up the large number of vacancies among the horticulture staff. All the permanent malis are in their forties and older; no one has been recruited for almost two decades. The shortage of staff is dealt with by hiring workers on contract. This practice makes it harder to transfer the skills of malis from one cohort to the next. Gardening knowledge that is acquired and passed on through a long-term hands-on relationship is lost when temporary malis don't get to stick around long enough to learn from the senior staff and the latter aren't motivated to teach those who might not be around the next year. So the temporary malis are relegated to doing the more basic jobs and the heavy lifting. Specialised skills acquired by working on the same task for years, such as making bonsai, are difficult to teach under such circumstances. More generally, the transition means the gradual tapering off of generations of workers who have a deep familiarity with the President's Estate, who know the distinctive features of each tree and flowerbed, as well as the sum of the landscape.

The steady shrinking of permanent jobs in the lower levels of the Indian government has been a broad trend in the last two decades. However, it has very specific implications for gardening, as indeed for

any vocation that requires sustained engagement with one's work. Excellence demands years of dedicated practice, the opportunity to learn and reflect, to try out new things and, most of all, to care about one's work and take pride in it. Only permanent jobs allow for these enabling conditions. Temporary jobs — without benefits or security — don't attract formally trained professionals with degrees in horticulture and landscaping either. When malis come and go, recruited from the ranks of 'unskilled labour', it becomes harder to maintain the standards of the Rashtrapati Bhavan gardens. Any manual work is looked down upon in India; the President's Estate can help to overturn this deep-seated social prejudice by making the skills of its malis more visible and valued.

The older malis look back fondly on their years on the Estate. They remember officers who took the initiative to send them to Iran in the 1970s to work on the royal gardens of the Pahlavis. Jagpal remembers President Zail Singh's time when several malis were recruited.[8] President Abdul Kalam was praised by several malis for improving their working and living conditions, including building toilets near the Herbal Garden — a major relief, especially for women workers. Malis recalled that when presidents walked in the Mughal Garden, they would stop and chat with them, inquiring after their welfare.

Individual presidents and their wives are also remembered for what they brought to the gardens: Zakir Hussain for importing rose varieties and for getting built the glass conservatory for succulents; Neelam Sanjeeva Reddy for encouraging citrus bonsai; R. Venkataraman and K.R. Narayanan for the banana varieties they brought from south India; Usha Narayanan for introducing tulips and ikebana floral arrangements; Abdul Kalam for installing the musical fountain, starting the deer and duck park and creating the Herbal and Spiritual Gardens; Pratibha Patil for sending the Dalikhana fruit and vegetables to an orphanage. Having said that, Sher Singh observed, '*Haan, hum* First Family *ke liye kaam karte hain, aur ye soch kar garv bhi hota hai, par sach poochho to public se jo taareef milti hai woh kuchh aur hai*' (Yes, we work for the First Family and we're proud of that but, to tell you the truth, it's the praise from the public, now that's something else).[9]



RIGHT:
Contract workers at roll call on a winter morning







Older malis who have a gift for colour and composition arrange flowers for the Rashtrapati Bhavan's rooms. These 'decoration malis' prepare the elaborate bouquets that adorn Durbar Hall during ceremonial events. They also fill the dainty vases that dot the tables and desks in offices and bedrooms

chapter five

Wildlife

CREATURES GREAT AND SMALL

GHAZALA SHAHABUDDIN

Before the President's Estate came to be built, the area was covered by what is technically called 'tropical thorn forest' and 'tropical dry deciduous' forest.[1] Only two patches of this native forest now remain within the Estate and can be found adjoining the Dalikhana. While these forest patches measure only a few hectares, they provide an important refuge for the wild biodiversity on the Estate. Their ecological significance is all the greater in a city where natural forests are rapidly disappearing.[2] However, like the forest of the Central Ridge from which the Estate is separated by Mother Teresa Crescent, the forest patches on the Estate have been modified over the years by human interventions.

The most striking example of such ecological change is the presence of vilaiti keekar.[3] The sprawling shade of this introduced species dominates the canopy of the wild areas where it has squeezed out many native species. Either first planted by the government to green the bare tracts of 'wasteland' in the Estate in the 1920s — as was commonly done across northern and western India — or spreading itself from the adjoining Central Ridge, this hardy survivor has now become the most common species on the Estate. Another tree, introduced in the 1980s, that has since become a pest, is subabool, the seedlings of which have sprung up vigorously wherever it was planted. Yet another invasive plant, the bushy lantana, can be seen at the edges of the forest patches trying to gain an entry.

Yet, despite the brooding presence of vilaiti keekar overhung with creepers, many native trees still survive. These include jungle jalebi, ronjh, khair, sickle bush and phulai — feathery-leaved mimosas with sharp spines, which give the 'thorn forest' its name; the otherwise nondescript chamrod which bursts forth with white star-like flowers in March; goolar with its clusters of figs growing from the trunk; bistendu and lasora, all of which belong to the native flora of Delhi.[4] The presence of their saplings in the understorey shows that some of these are regenerating well, but others are struggling to stay on. One can also see young saplings of native trees such as doodhi, amaltas and kanju trying to establish themselves. Also common are cultivated species such as maulsari, putranjiva, kadi patta, kosam, kamini and khirk that are exotic to the Ridge forest ecosystem and have probably escaped from gardens



Blister B..tle on a go..enrod bud





Natives of Delhi's thorn forests:

ABOVE:
Chamrod flowering is often triggered by rain

RIGHT:
New leaves on the jungle jalebi sprout directly from the trunk
[Photo credit: Brinda Datta]

and parks nearby. These are currently flourishing in the forest patches, particularly in the low-lying moister spots. Also present here are some large old trees of son khair, which is not found anywhere else in Delhi and which may have been planted as an experimental species for afforesting the Ridge. Below these trees grow a number of perennial shrubs and annual herbs that create a dense understorey.[5]

Gnarled old trees of ber, peelu and kaim, seen in the Spiritual Garden adjoining the forest patches, are traces of the diverse scrub forest flora supplanted by cultivation. These trees were probably spared when the forest was cleared to create the garden. Their presence is a reminder of the very different landscape that existed here before the Estate was built.

While the thorny scrub forest formed the original template for the Estate, many different habitats were gradually carved out from it over the years. The formal gardens and the Forecourt; the Dalikhana or kitchen garden with its vegetable plots, orchards and nursery; the golf course, tree-lined avenues and residential gardens were a part of the original plan. Three 'thematic' gardens — two for medicinal herbs and the Spiritual Garden — were also added later. With landscaping and plantings intended for different uses, these diverse areas combine to create an ecological mosaic that supports many life forms. Although much modified through the years, all the different habitats put together create a diverse blend of spaces for a surprisingly large range of organisms — from large vertebrates such as mammals and birds to tiny creatures such as spiders and earthworms. Ecologically, each of these spaces differs from the others in terms of the resources that it offers for different animal species. Although the breeding habitats of species may be restricted to one or a few sites, many of them move between and feed in a variety of areas. This patchwork of habitats thus allows us to observe how wild flora and fauna establish in their preferred habitats while still using resources present in others. This rich habitat mosaic is truly much more than the sum of its parts.

BELOW:
Though dominated by vilaiti keekar, the jungle patches on the Estate have a dense understorey of shrubs and herbs



LIFE IN THE FOREST UNDERSTOREY

THE FOREST UNDERSTOREY refers to the vegetation layer formed by the low-growing shrubs, saplings, herbs and grasses in the forest. The kinds of species growing in the understorey, and their health and density, are said to affect the health of the forest. This low-growing vegetation, along with forest leaf litter, provides cover for many ground-dwelling birds, reptiles and small mammals such as jackals, mongooses, francolins and peafowl. A diversity of herbs and shrubs provides host plants and nectar-plants for butterflies, beetles, bugs and moths.

In the forests of the President's Estate, the understorey is made up primarily of heens, a thorny bush that sometimes climbs up high in the canopy, using trees for support. Other native species in the shrubbery include gangerun and hingot, which is relatively rare, as well as saplings of tree species such as bistendu. Seasonal herbaceous plants such as jhinti, vajradanti, adulsa, chitrak, kalaghavani, and atrilal provide much-needed nectar and herbage for insects and birds for large parts of the year. During the monsoon, the forest understorey comes alive with several species which could not survive but for the dense cover and leaf volume. The Bush Cricket, the Flea Beetle, the iridescent Leaf Beetle, the brilliant Long-horned Grasshopper and Broad-headed Bug are among the species found in the shrubbery.



ABOVE: Flea Beetles eating leaf tissue

LEFT: Long-horned Grasshopper

As a microhabitat, the forest understorey has all but disappeared from many Indian forests due to being cut for fodder or grazed by domesticated livestock, timber felling and the creation of single-species plantations of exotics, collection of leaf litter, and fires set to aid the collection of forest produce. Over time, such practices discourage the germination and growth of seedlings, saplings and other vegetation and thus reduce valuable niches for animals. Opening up the understorey and the loss of the leaf litter layer also dries up the soil and slows the rate of decomposition. This is because decomposer organisms such as fungi, earthworms, beetles, ants and millipedes require a moist, complex and multi-layered environment to survive and reproduce. Therefore 'beautification' of the wild patches by replacing the understorey with lawns and ornamental plants should be strictly avoided.







ABOVE: Leaf Beetle

BELOW LEFT: Kalighavani

BELOW RIGHT: Chitrak



INSECTS

BIOLOGISTS BELIEVE that 73 per cent of all the animal species present on earth are insects.[6] Marvelling at their tremendous importance for ecosystem functions, the renowned biologist E.O. Wilson called insects the 'little things that run the world'.[7] Their sheer numbers enable essential ecological processes such as organic decomposition, provisioning of food chains and flower pollination, today widely referred to as the 'ecosystem services' that nature freely provides.[8]

Intensive surveys show that the President's Estate, too, is home to a large diversity of insects. A total of 96 species has been recorded so far.[9] The most numerous and visible are the butterflies, beetles, dragonflies, bees and wasps. Insects abound in all their variety, especially during and just after the rains when warm temperatures and the luxuriant growth of vegetation provide ideal conditions for growth and reproduction. The peak in flowering of several trees, shrubs and herbs during the post-monsoon period also provides abundant nectar, pollen and young leaves which are food for many species. Predatory insects higher up the food chain such as praying mantises and dragonflies are, in turn, boosted by the abundance of insect prey during this period. Decomposers such as Dung Beetles, termites and ants work through vast volumes of dead plant and animal material, turning them to nutrient-rich soil. Being protein-rich, insects are also a major food for larger animals including birds, geckos, lizards and mongooses.

ABOVE:
Praying Mantis

BELOW:
Grasshopper



Why is there such an immense diversity of insects on earth? Pioneering biologists Paul Ehrlich and Peter Raven observe that it is the diversity of plant species that largely fuels the evolution of insect species.[10] Insects have co-evolved with different plant groups and families as plants evolve toxins to defend themselves against insects that would eat them. As the production of toxins can be extremely 'expensive' in terms of energy for plants, every plant species eventually evolves to produce only one or a few types of toxins, for instance, cyanides. Thus millions of years of co-evolution between plants and insects have resulted in closely related groups of insects that have evolved to feed on a few related plant species whose toxins they can neutralise.



Ants devouring a dead grasshopper



BUTTERFLIES

A PROMINENT example of plant and animal co-evolution are the butterflies on the Estate. A single butterfly species lays its eggs on only a few related plant species, which scientists call 'larval host plants'. The caterpillars, upon hatching out, eat the leaves of that plant species only and, after pupation, emerge as colourful butterflies.

The monsoon season is the time when butterflies are most abundant as plants tend to put forth leaves and shoots with renewed vigour. A total of 35 species of butterflies have been recorded on the President's Estate.[11] The most common family of butterflies is the group *Pieridae* which includes the Common Grass Yellow, the Lemon Emigrant, the Pioneer and three species of orange-tips — all coloured in whites, yellows and oranges. The sun-loving *Pierid* butterflies are active in brightly lit open areas and forest edges and their caterpillars feed on the leaves of the bushy heens, commonly found as an understorey shrub in the scrub forest. A species never before seen in Delhi — the Striped Albatross — was recorded here in 2014. Some of the smaller *Pierids,* such as the Small Orange-tip, do not venture far from where they hatch but others such as the Common Emigrant are fast-flying and far less specific about where they forage to find nectar. Two swallowtail species seen commonly here — the Lime Butterfly and the Common Mormon — both use citrus trees as their food-plant. The extensive citrus orchards in the Dalikhana probably explain the abundance of these two species. Both swallowtail species are fast and strong fliers; they rarely sit long anywhere and roam widely to find suitable host plants on which to lay their eggs. The Blue Pansy and Peacock Pansy

ABOVE:
As its name suggests, the Lime Butterfly lays its eggs on citrus trees where its larvae can feed on the leaves

mainly frequent the gardens and parks, often sitting in sunny patches with their wings open and feeding on nectar-rich flowers. If one looks closely, the tiniest of butterflies, the Common Silverline, the Striped Pierrot and the Tiny Grass Blue, reveal intricate and colourful patterns.

While butterflies are very specific to their larval host plants, they are less choosy when it comes to the flowers they use for nectar. Butterflies can be seen feeding on all types of flowers, from the tiny flowers of the herbs doodhiya choti and atrilal in the forest to the brush-like catkins of khair, from the brightly coloured lantana and the coral creeper growing along the edges of the forest to garden plants such as bougainvillea and firebush (*Hamelia patens*) which flower almost throughout the year. The only factor that may constrain butterflies in their nectar-feeding is whether the flower can support their size. The tiny, low-growing flowers of kharenti and doodhiya choti host the Pale Grass Blue, a butterfly less than a centimetre in wingspan, while the Lime Butterfly (a large swallowtail) is usually seen on larger garden flowers such as cosmos, coral creeper, rosy periwinkle and bougainvillea.

Patches of mud also attract butterflies who use their proboscis or feeding tube to suck in water in order to filter it for useful minerals. This is called 'mud-puddling'. At the height of the monsoon, swarms of butterflies can be seen mud-puddling in the wet earth left over after rains or after watering of lawns and gardens. Butterflies tend to be vulnerable to predators such as birds and reptiles when they are mud-puddling and this is the place for a hungry Common Myna, Indian Peafowl or Jungle Babbler to grab a bite to eat.

BELOW:
The Lemon Emigrant is common on the Estate, frequenting forest patches as well as gardens. Here it sips from a bougainvillea flower





Striped Pierrot butterflies mating on a flowering ber tree



KEYSTONE SPECIES OF DELHI'S FLORA

THE TERM 'KEYSTONE SPECIES' refers to an animal or plant species that plays a critical role in an ecosystem, the loss of which could cause the latter to collapse. For instance, the Sea Otter played a keystone role as a marine predator off the Californian coast. When its numbers plummeted as a result of intensive hunting in the nineteenth and early twentieth centuries, there was a rapid increase in the population of sea urchins, its favoured food. The population explosion of sea urchins, in turn, led to loss of the kelp algae — food for many other marine species such as the Killer Whale which, consequently, became rare. Similarly, the Bengal Tiger is often referred to as a keystone species as its loss from an ecosystem can lead to over-population of deer species such as the Sambar, Chital and Nilgai. Over-abundance of such herbivores can significantly degrade forest habitat, particularly in areas of tropical dry forest.

On the President's Estate, trees belonging to the fig family (*Moraceae*) such as peepal, banyan, goolar, pilkhan and laurel fig, comprise a widely recognised group of keystone species. They are important food species for birds, mammals and insects because of their unique ability to fruit asynchronously as a population. Thus fig fruit is available throughout the year, even in winter, as individual trees fruit at different times, rather than all at once during a single season. The large diversity and ubiquity of fig trees on the Estate is probably why fruit-eating bird species such as Yellow-footed Green Pigeon, Indian Grey Hornbill, Alexandrine Parakeet, Brown-headed Barbet, Common Hawk Cuckoo are so abundant here.

Two species of trees on the Estate, khair and ber, when in flower, provide a generous supply of nectar to insects, and also could be playing the role of keystone plant species for this habitat. Numerous species of wasps, bees, flies and beetles have been observed feeding on their flowers.



A Common Silverline feeding on a spike of khair flowers



A Striped Pierrot sipping nectar from a ber flower

MOTHS

UNLIKE BUTTERFLIES, bright and active during the day, moths are harder to spot. Since they are generally nocturnal, most people remain unaware of them as they go about nectar-feeding and mating. Yet, moths are far more numerous than butterflies in most ecosystems, often nine times as many.[12] They are also more effective in flower pollination than butterflies as they have feathery antennae and hairy legs and bodies to which pollen sticks. 'Moth flowers' tend to be pale-coloured, often opening and releasing their fragrances in the night. On the Estate, moths can be seen feeding on the nectar of flowers of the drumstick tree, raat-ki-raani, kamini, harshingar and saptaparni. The sweet scents that plants exude are intended to lure pollinating moths and, possibly, bats, but they also beguile humans into growing them and thus spreading particular plant species.

Ranging in size from a few millimetres to more than 6 inches, moths look rather dull compared to butterflies. Their relatively muted colours probably stem from their need to stay cryptic during nighttime, yet a closer look reveals complex patterns. A total of 24 species of moths have been reliably identified on the Estate.[13] These include several species of moths belonging to the family *Geometridae*. Their name derives from the Greek 'measuring the earth' because of how their larvae inch forward on the ground. The Tussock Moths are another group of moths, so called because their larvae have dense tufts of hair like grass. Like butterflies, moths have closely evolved with plant species containing particular groups of plant toxins. Common in the Dalikhana in summer is the Cucumber Moth whose caterpillars feed upon various species of the gourd family — snake gourd, bottle gourd, cucumber and zucchini — that grow in the kitchen garden. A large number of tiny, dull-coloured moths, known as the Grass Moths, can be rustled out from grasses and shrubs in the monsoon where they hide out during the daytime.

Moths have intricate designs on their wings which



RIGHT:
The 'eyes' on the back of an Owlet Moth are meant to confuse predators





ABOVE:
Tussock Moths can be recognised by their feathered antennae and fringed legs

LEFT:
A female Cucumber Moth fluffs out the hairy tuft at the tip of its abdomen to spread pheromones to attract males

serve the double function of acting as camouflage and making them attractive to members of the opposite sex. The Plume Moth's wings are barely recognisable as such, being shaped like narrow feathery plumes.The handsome Tiger Moth has a sleek black-and-brown design on cream-coloured wings which camouflages it on dead leaves in the forest litter. The most striking species, the Owlet Moth, is beautifully outfitted in a khaki-green, black and cream garb and has two prominent eyespots on the forewings when at rest. Such eyespots on the wings, present in several other moth species, are thought to deflect potential predators from the most vulnerable parts of a moth's body — its head and thorax.

Moths are tightly packed bundles of energy, full of fat and eggs. Thus they are prime food for birds, bats and small mammals, many of whose routines are calibrated to those of their prey. On a warm monsoon evening, Spotted Owlets and bats can be seen trying to catch moths for dinner. Rats, mice and mongooses clean up the remains of the night-catch from the ground underneath. Some moths have developed effective anti-predatory devices for flying predators. They produce clicking sounds that imitate the supersonic calls of bats,[14] thus confusing these predators during their aerial attacks.

RIGHT PAGE
ABOVE:
The dusty green sheen of this moth blends with the leaf on which it sits

BELOW LEFT:
Its prominent club-like antennae help distinguish an Antlion from the dragonflies and damselflies it resembles

BELOW RIGHT:
A tiny Orb-web Spider folds itself between the florets of a tulsi blossom

THIS PAGE
BELOW:
Cryptic colours and intricate wavy patterns help camouflage *Geometridae* moths









CAMOUFLAGE AND MIMICRY

MIMICRY OF other species is a common phenomenon in the animal world, particularly among insects and spiders. For instance, it has been found that some butterfly species that are palatable to birds may mimic other species that are known to be poisonous. This way, they have a good chance of being avoided by predators. One example of this seen on the Estate is the Common Mormon, whose female mimics the Common Rose, a distasteful species. Camouflage, which refers to animals closely resembling their natural background, is another trick to avoid predation. The *Neoscona* spider, which lives in the flowers of the tulsi plant resembles the flower in colour and carefully folds its legs to fit the petals of the flower so as to avoid being seen during the day. The Garden Lizard is also able to subtly adapt its skin colour to its background for the same reason. The Common Evening Brown is a butterfly that flies low in the shrubbery and settles in dead leaf litter, such that it stays hidden from ground predators and insect-eating birds.







RIGHT:
This Dwarf Honey Bee cannot see the red colour of this poppy. Instead, a ring of ultraviolet colour invisible to the human eye guides it to the yellow central landing zone where nectar and pollen lie

BELOW:
Paper Wasp feeding on ber flowers

RIGHT PAGE ABOVE:
Flowerfly on ber

RIGHT PAGE BELOW:
A Dwarf Honey Bee on a coral creeper

POLLINATORS IN DANGER



FLOWER POLLINATION is a symbiotic relationship in which two different species engage in a give-and-take that benefits both sides. While animals obtain pollen and nectar from flowers, plants benefit from having their pollen carried to other individuals for fertilisation.

Plant species invest a lot in mechanisms to attract pollinators to their flowers. They produce attractive flowers, nectar, oils, fragrances and nutritious pollen grains which tempt pollinators.[31] Most commonly, pollinators include insects such as bees, wasps, beetles, butterflies and moths, but also mammals such as squirrels and bats, and birds such as sunbirds and orioles. However, social bees and wasps tend to be the most effective pollinators of plants in the wild as they fly large distances and require huge amounts of nectar. Globally, scientists have identified as many as





25,000 bee species and 4,000 wasp species that are active in pollination.

Bees, particularly, have highly specialised structures for carrying pollen. Their long tongues help them slurp up nectar from flowers. Their hind legs have spurs, rakes, brushes, hairs and even baskets to transport pollen.[32] Moths are also important pollinators because they have fine hair on their legs, body and antennae to which pollen can attach easily and thus be carried from one flower to another. It is believed that these intricate adaptations of insects to flowers are a result of co-evolution in which pollinator and pollinated alike continually adapt to each other over millennia. Interacting sets of plant and animal features usually form consistent patterns. For instance, long tubular flowers are mainly pollinated by sunbirds and hummingbirds that have long bills to penetrate them. Similarly, brightly coloured flowers attract butterflies, wasps and bees that have colour vision and that feed only during the hot, daylight hours.

The President's Estate has a rich variety of pollinators including three species of bees — the Rock Bee, the Dwarf Honey Bee and the Carpenter Bee — and several species of wasps such as Paper Wasps, Potter Wasps, Cuckoo Wasps and Chalcid Wasps. Leaf Beetles and Blister Beetles are also commonly seen on flowers but they tend to be less effective as pollinators due to their limited flight range and slow movement. The Flowerfly, though it looks like the Housefly, is mainly a nectar-feeder and a good pollinator; several species of it are found on the Estate.

Lately, scientists have warned that the world may be facing a pollinator crisis, a noticeable decline in the number of insect pollinators, due to habitat degradation, pesticide pollution, poor nutrition and viral diseases. In some endangered plant species, it has been documented that breaches in habitat caused by highways and urban settlements have reduced rates of pollination. Further, loss of native forest can deprive pollinator species of 'keystone' nectar sources. Thus it is essential that maximal diversity be preserved in existing natural forests if pollination services are to be maintained for fields and orchards in the future.



DRAGONFLIES

WHEREVER THERE ARE pools and puddles, tanks and streams, swimming pools and lakes, one is bound to see dragonflies and damselflies soaring and hovering in the air above. These fast-moving predators of the air specialise in catching tiny insects on the wing. Dragonflies mastered the art of flying early on in evolutionary history — 250 million years ago — and some of them are called 'living fossils' because of this ancient lineage. They have powerful flight muscles and incredible manoeuverability, making them extremely difficult to photograph or catch, as any field entomologist can testify!

Both dragonflies and damselflies have a complex lifecycle involving both water and land.[15] They lay their eggs underwater on submerged vegetation close to the land's edge. Their larvae are adept at ambushing aquatic insects and the larvae of other insects. Dragonfly larvae are considered to be bio-indicators of water quality as most cannot survive in polluted water that is high in organic matter or toxins.[16] Dragonflies also need sufficient vegetation at the water's edge in the form of reeds, grasses and rushes so that they can perform territorial displays, attract mates and rest in between predatory sallies into the air. Thus they demand a definitive interlocking set of microhabitats for survival.

On the President's Estate, six species of dragonflies and one species of damselfly have been recorded so far. The most common are the orange-coloured Rock Glider and yellowish-green Ruddy Marsh Skimmer. Another attractive species, though rare here, is the Crimson-tailed Marsh Hawk which, true to its name,

ABOVE:
Ditch Jewel Dragonfly on a *Cenchrus* grass flower spike

has a gaudy crimson-pink tail which stands out in the vegetation. The largest species of all, the Black Marsh Trotter, with striking red and black stripes on its body, is even rarer. It can be identified by the black patches on the part of the wings closest to the body. The only damselfly seen on the Estate, the dainty Coromandel Dart, has a bright yellow tail and bluish-green head and body. It is often seen flying weakly in the dense shrubbery and grass overlooking the pond in a corner of the Dalikhana.

Dragonflies tend to be territorial and any puddle of water, however small or short-lived, is likely to have a dragonfly laying claim to it. Besides the Dalikhana, where they can be seen settled on plants and stones at the edge of the pond, or soaring above it in large numbers, they are common around the sandstone-lined pools and channels in the Mughal Garden, often found resting on the edges during early morning and late afternoon. The numerous dragonflies on the Estate can be credited with controlling noxious flies, mosquitoes and other insects in the area.

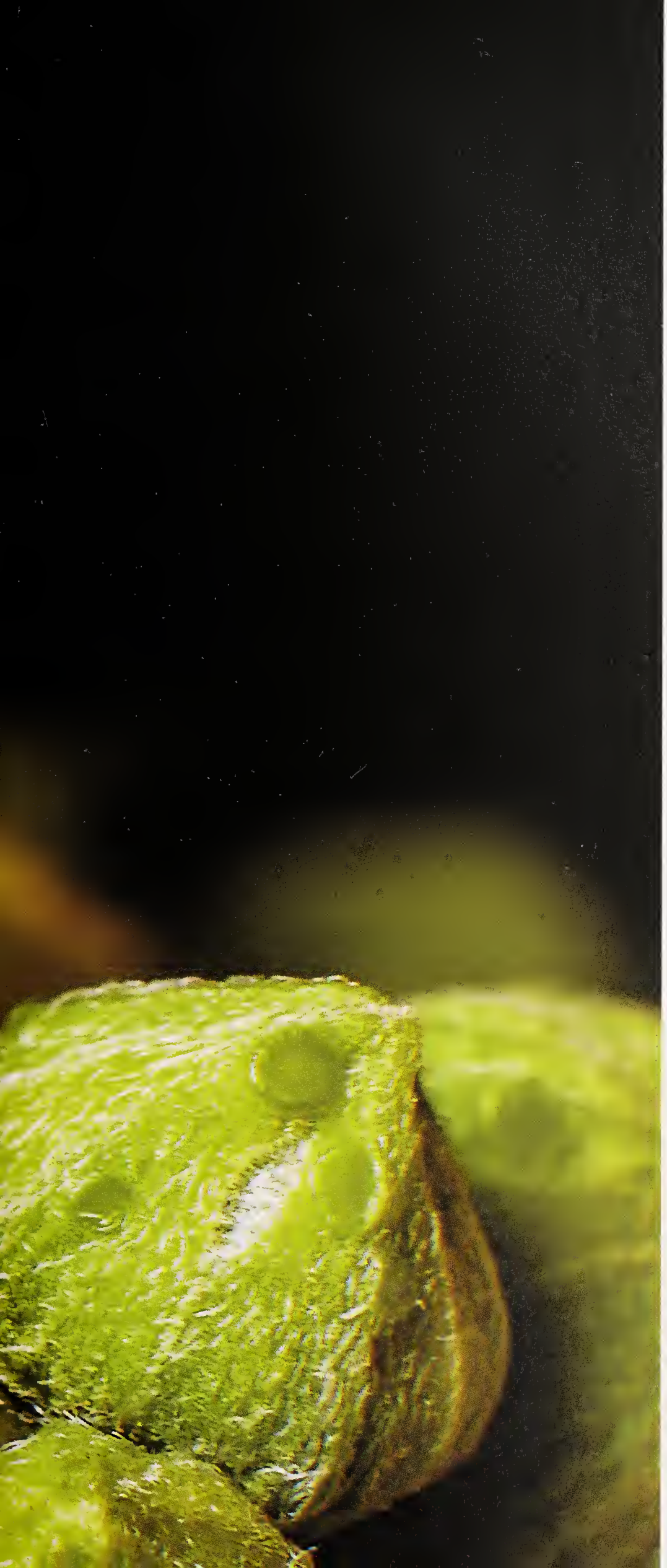




ABOVE:
Tall grasses and clean water provide ideal dragonfly habitat

LEFT:
Coromondal Dart Damselfly





SPIDERS

SPIDERS ARE keen predators that eat only insects. Consequently, in a place like Delhi, they are most common during and after the monsoon when insect life reaches its peak. Spiders become harder to spot during the autumn and almost disappear in the cold season. No one knows how spiders get through the bitter Delhi winter but it is likely that they survive as eggs or spiderlings which can escape the cold in a curled leaf or below a stone.[17] Spiders reappear during the warm days of spring though they do not reach the same numbers as in the monsoon.

Spiders are everywhere. They can be seen in gardens, orchards, forests and houses. Even a casual look can reveal spiders hiding in flowers, resting and hunting on leaves, and making webs on tree branches and shrub twigs. There are spiders living on tree bark, in leaf litter, under stones, on walls and signboards and in disused buildings. Spiders show immense diversity in form, size, colour and predatory mechanisms.[18] On the President's Estate, as many as 49 species of spiders, belonging to 16 different families, were recorded in 2014.[19]

Spiders have an impressive array of adaptations that makes them formidable predators in their tiny world. Most spiders have three to four different sets of eyes which gives them telescopic vision, stereoscopic wide-angle lenses and close vision. Together, the eyes allow spiders to detect movement, recognise their prey and judge distance accurately before they pounce for the kill. Some species, such as the Jumping Spiders, have eyes that allow almost 360-degree vision.[20]

LEFT:
Crab Spider carrying its Flowerfly prey across the buds of a gourd plant in the Dalikhana

ABOVE:
Decorative Silver
Orb Spider

Spider webs come in many forms and sizes but the one most familiar to the layperson is the kind built by Orb-web Spiders which is a symmetrical structure in a wheel-and-spoke formation. Spiders are unique in making silk for their webs, which is actually a protein-based material with the tensile strength of steel. Nocturnal spiders rebuild their webs every night. The Garden Spider belonging to the *Argiopes* genus is also an orb-web weaver but creates a dense cross-shaped web embedded within its larger web. It carefully arranges its legs along the cross, thus making itself invisible to passing insects. The Mesh-weaver Spider makes its dense silken retreat underneath a leaf, where it stays hidden until the time comes for hunting. Funnel-web Spiders, such as the *Hippasa,* make a funnel-shaped web attached to grass, wide at one end and narrow at the other, and wait for insects to fly or jump into the wide end. They can be found hiding in empty flowerpots where they catch tiny insects coming in search of a place to live. The Cobweb Spider constructs the untidy, tangled webs on the ceilings of houses which are familiar to most people.

Spiders are very sensitive to vibrations and, sensing when prey is captured in their webs, rush to the site to deal with it. Several species, such as the Lynx Spiders, have sharp spines on their legs which help them manoeuvre the hapless insect that is caught. Once caught and immobilised with the help of venom, spiders inject digestive juices into the body of the prey and then suck out the semi-digested tissues. All animal matter is fair game

to spiders. Some are famous for their cannibalistic tendencies where the females eat up the male spider soon after mating. Others, such as the *Stegodyphus*, are known to eat their prey alive, after wrapping the victim in a shroud of silk.

While spider webs are the commonest way in which they capture their prey, many spiders do without them. Wandering Spiders, Lynx Spiders, Wolf Spiders and Jumping Spiders are active hunters that ambush and carry away their prey. The Wolf Spiders and Wandering Spiders mainly hunt on the ground and are usually seen on the forest floor while the Jumping Spiders scour the bark of trees and shrubs for prey. These are some of the most commonly seen spiders on the Estate, often climbing on the flowerpots, bricks, walls and fences that they encounter during the course of their daily forays.

Spiders effectively use camouflage to conceal themselves from potential prey. Some merge perfectly with the colour of the flowers in which they hide, which they use as cover to ambush insects that visit for nectar.[21] Several species of Lynx Spiders are also seen on the Estate, often resting with their spiny legs folded to fit into a flower, from where they can capture prey. The Tree-trunk or Two-tailed Spider has stripes in different shades of brown on its legs, allowing it to merge perfectly with the bark of trees when it sits flat against the surface. Ant-mimicking Spiders use a rather novel form of camouflage. They imitate the relatively harmless ants in the way they walk. Insects do not notice them as predators and they are, therefore, able to sneak up to their prey — a veritable wolf in sheep's clothing!

Spiders show a remarkable amount of parental care.[22] The females of several species carry around their fertilised eggs in an egg sac, made of silk strands, which they do not give up easily even if they are disturbed. Females of Wolf Spiders are often seen moving around with a spherical egg sac, attached to their spinnerets.[23] The *Oxyopes*, a type of Lynx Spider, builds its nest under leaves where it guards its egg sacs. The *Pholcus*, a type of Cellar Spider, even carries its egg sac in its mouthparts until the eggs hatch.[24] Keeping eggs safe from predators is very important.



LEFT:
Lynx Spider on a canna bud





ABOVE:
The Common Wolf Snake is not poisonous but closely resembles the venomous Common Krait

LEFT:
The nocturnal Brahminy Worm Snake is blind and eats insect eggs and larvae

RIGHT PAGE:
The Buff Striped Keelback lives near water where it can find frogs and toads to eat

REPTILES AND AMPHIBIANS

FOR SUCH a small area, the President's Estate harbours a surprisingly large number of reptiles.[25] While snakes are difficult to see, gardeners and other residents report seeing Spectacled Cobras and Ratsnakes frequently during the course of their activities. Ratsnakes are often killed by local people who mistake them for cobras, though they are not poisonous and feed on rats, birds and lizards. Brahminy Worm Snakes, which are among the tiniest of snakes, barely 30 cm long and more slender than an earthworm, are common in swampy areas that have a dense layer of leaf litter.

The Spotted Supple Skink is commonly seen in the thick cover of the forests adjacent to the Dalikhana but rarely outside. Skinks are unusual creatures in that they are neither lizard nor snake but rather something in between and belong to a reptile family of their own (*Scincidae*). They are usually 4–5 inches long, shiny, and slither on the ground like snakes. They are ground-dwellers, and feed on insects in the moist forest leaf litter, under stones and in the low herbage.[26]

The Oriental Garden Lizard is abundant on the Estate and is often seen on rocks, paths, trees and bushes in the gardens, hedges and open scrub areas, wherever some undergrowth and leaf litter remains on the ground. It is notable for being able to alter its colour and pattern to merge with the substrate it is resting on. The much larger Indian Monitor Lizard used to be seen by the gardeners in the Dalikhana, though infrequently. This predator and scavenger eats arthropods, small mammals, birds' eggs and dead animals. It is mainly ground-dwelling, resting in burrows and low tree cavities. It has not been spotted recently so it may have disappeared, especially as the wild spaces on the Estate have shrunk.[27]

Four species of amphibians, including the Indian Marbled Toad and the Ornate Narrow-mouthed Frog, have been spotted on the Estate, living in the damp, low-lying areas of the forest and the ponds of the Dalikhana. They tend to inhabit places thick with grasses, weeds and trees, and are only conspicuous during the monsoon months.





ABOVE:
Oriental Garden Lizard on a croton plant. The male becomes very territorial during breeding season, turning a bright red and bobbing up and down aggressively before a competitor





ABOVE:
Ornate Narrow-mouthed Frog

LEFT:
Indian Marbled Toad

MAMMALS

Only seven small mammals have been seen on the President's Estate: the Small Indian Mongoose, the Golden Jackal, Rhesus Macaque, the House Shrew and the Five-striped Palm Squirrel and two species of bats. The forests of the adjoining Central Ridge additionally boast of several species of mammals such as the Nilgai, Brush-tailed Porcupine and Black-naped Hare. These are likely to have been present on the Estate when it was not so isolated from the adjoining Central Ridge and the habitat within not so fragmented.

The presence of a small population of Golden Jackals enhances the sense of wilderness in an otherwise manicured environment. They are often seen in the scrub forest and in the adjoining Dalikhana early in the morning and at dusk. The scrub forest patches are a refuge where they can rest concealed during the daytime, hidden in the thorny and dense vegetation that humans avoid. Under cover of darkness, the jackals venture outside the forest to feed, taking ripening fruit and vegetables from the orchards and scavenging in the trash piles and garbage dumps along the forest edge. Jackals can also feed on the smaller animal life of the forest such as insects, geckos, rats and ground-dwelling birds such as the locally common Grey Francolin and Indian Peafowl. Hidden cameras set up in the forest in 2014 recorded jackal activity at night. A pair of jackal pups was photographed in the forest, showing that there is some breeding in this small population. However, the jackals within the Estate are not as healthy as those seen in wildlife sanctuaries, possibly because food resources are now more limited here. Further, a number of other mammals such as feral cats, stray dogs and Rhesus Macaques compete with the jackals for scarce food.



RIGHT:
Small Indian Mongoose
[Photo credit: T.K. Sajeev]



ABOVE:
Camera trap photo of Golden Jackals crossing a Dalikhana path at night [Photo credit: Dhruv Pal]

The Golden Jackal used to be one of the most common small mammals inhabiting the Indian countryside, living in forests and grasslands and, since it is able to live around human settlements, also in suburban parks and gardens at the forest edge. However, today the jackal has disappeared from many areas where it used to be common and no one knows why, though we know that the ones on the Ridge adjoining the Estate were ruthlessly hunted as vermin.[28] The poor nutritional status and small number of jackals on the Estate does not bode well for them and they are likely to disappear from here too, if their core habitat of the scrub forest and adjoining kitchen garden continues to shrink and suffer from disturbances.

The Small Indian Mongoose is another mammal that is seen on the Estate, most commonly in the Dalikhana where the kitchen gardens, orchards, forest and composting areas provide a variety of prey such as rats, birds, reptiles and insects. The mongoose is often seen in pairs and lives in burrows and ditches. It tends to stay under cover to avoid larger predators such as the ever-alert Black Kites and is often seen dashing across open paths. It is a small but fearsome predator, with a low-slung walk and muscular, lithe body. Due to its speed and agility, it can easily outwit ground-dwelling birds such as the Grey Francolin and the Common Peafowl. This is the commonest of Indian mongooses, and is closely associated with human settlements.[29] It has apparently adapted well to city life, being seen commonly in gardens, street-side greens and parks in Delhi.

The abundance of fruiting trees such as peepal, banyan and goolar on the Estate provides a feast for the Indian Fruit Bat (also called Flying Fox), large groups of which can be seen at twilight, silently flapping their way into the Estate to spread out and feed. Easy to recognise because of their orange and brown fur and large black wings, they spend the daylight hours roosting up in the tall trees of Lutyens's Delhi. A particularly favoured roosting spot is the line of old arjun trees growing on Janpath, about 500 metres from the Estate. Looking up, one sees hundreds of bats hanging upside down.



Camera trap photo of Golden Jackals at the boundary of the jungle patch [Photo credit: Munish Gupta]

HABITAT FRAGMENTATION

FRAGMENTATION OF a continuous natural landscape has impacts upon animal and plant ecology much beyond the simple loss of wild habitat.[30] In the modern world, fragmentation of forests and wetlands typically takes place when roads and highways, urban settlements, dams or bridges are constructed. Several animal species, particularly mammals, require large continuous habitats to hunt and forage since they require more food to sustain themselves. Carnivores such as leopards and jackals that feed on prey that may range over large areas, are especially vulnerable when natural habitats shrink or get broken up. Other vulnerable species include those that are specialised, such as pythons that require rare swampy areas or hornbills that can survive only off clusters of fruiting trees. When animals are confined in small fragments, their population becomes less vigorous and viable over time due to inbreeding, lack of immigration and inability of individuals to find mates among the dwindling numbers.

When the President's Estate was created out of the scrubland then constituting the Delhi Ridge, animals would have ranged over the entire area, a mosaic of dry thorn forest and village fields. Animals opportunistically use certain areas for foraging and others for breeding but they are far more adaptable when it comes to foraging. People who have been living on the Estate for several decades report seeing mammals such as Nilgai and Golden Jackals frequently in large numbers up until the 1960s. In fact, gardeners report that they had to employ chowkidars to keep the Nilgai away from the kitchen gardens as they could cause a lot of damage.

The building of Cantonment Road (now Mother Teresa Crescent), skirting the western boundary of the Estate, created a major break between the Central Ridge forests and the Estate. However, road traffic remained sparse until the 1970s, allowing many species to move between the Ridge and the Estate. By the 1990s, however, dense and fast-moving traffic on these roads made them major barriers to the movement of animals, such that their populations within the Estate were cut off and dwindled over time, some disappearing altogether.

If underpasses are built between the Estate and the Central Ridge, a wildlife corridor can link the forests and bring in many more animal species than are currently present. The Central Ridge currently harbours species such as the Black-naped Hare, Nilgai and Brush-tailed Porcupine which could repopulate the President's Estate if given a chance. Of course, for these animals to thrive there, the wild patches need to be protected and even allowed to spread.

BRINGING BACK THE NATURAL FOREST

WILD BIODIVERSITY is an important element of the President's Estate. While the mosaic of man-made and natural habitats creates its own synergies, the natural forest patches preserve many animal species and many ecological processes that cannot exist elsewhere. For instance, termites, skinks, mongooses and monitor lizards, while they use the habitats outside opportunistically, would not survive without their core forest habitat. The Grey-breasted Prinia, the Olive-backed Pipit, Greenish Warbler and Grey-headed Canary Flycatcher are among the birds that are rarely, if ever, seen outside these forests.

Forest management practices that encourage the growth of existing tree saplings will help in restoring the native Ridge forest of Delhi on the Estate. This can be done by opening up the canopy, by cutting back and uprooting vilaiti keekar and subabool, and replanting native species. Bringing back native herbs and shrubs that belong in the understorey will be essential too, because only trees do not an ecosystem make. Importantly, planting trees that are not native to the Delhi region, such as mango, teak, katsagon and Norfolk Island pine, as was done from time to time, should be stopped. The dumping of trash and construction waste in these dwindling forest patches has to be strictly prohibited. The ecological restoration and protection of the tropical dry scrub and deciduous forests within the President's Estate, if achieved, can be a useful model for similar restoration in other parts of the city. With some effort, the forest can even become a place for education, recreation and research, where its wonderful biodiversity can be enjoyed by all.

BELOW:
A restored native forest might look like this [Photo credit: Pradip Krishen]



chapter six

Birdlife

HEIRS OF THE ECOLOGICAL MOSAIC

GHAZALA SHAHABUDDIN & AMITA BAVISKAR

By the year 1928, as the construction of the Viceroy's House neared its end, work began on the surrounding gardens and grounds. Raisina Hill's rocky scrubland was levelled, covered with tons of fertile soil and provided with plentiful irrigation. Water pools and fountains were put in. Hundreds of citrus, guava, jackfruit and litchi saplings were planted in the Dalikhana orchards. Thousands of trees were planted along avenues and in gardens. Tens of thousands of flowering shrubs, creepers and annuals were grown in the formal gardens, along roadsides and around the bungalows. Wide grassy lawns were laid to the north and south of the House and on the golf course to its south-west. Patches of planted up thorn forest on the western side adjoining the Ridge were fenced off for protection. Over the last 85 years, this diverse landscape with its multitude of native and introduced species has matured: the trees are fully grown and the wild area has turned into dense jungle. As the vegetation has established itself, it has in turn changed the soil content and moisture regime on the Estate, creating new micro-habitats that provide shelter and food to a remarkable variety of birds.

A survey by the Bombay Natural History Society conducted in 2002–03 recorded 90 species of birds in the President's Estate's gardens, tree-lined avenues, forest remnants, kitchen garden and other habitats.[1] Thomas Mathew added another 28 species to the list. His richly illustrated book is a visual record of a range of bird behaviour observed at close quarters over an extended period of time.[2] Intensive field surveys conducted by Ghazala Shahabuddin during August 2014–July 2015 added another three species, bringing the total number to 121.[3] The rich birdlife of the Estate is testimony to the fact that birds thrive in human-made as well as natural habitats, showing that urban gardens can be as important as wilderness for nurturing bird biodiversity.







LEFT:
Red-whiskered Bulbuls
[Photo credit: Ranjit Lal]

RIGHT:
Red-vented Bulbul
[Photo credit: Brinda Datta]

RIGHT PAGE:
Male Purple Sunbird
[Photo credit: Suniti Bhushan Datta]

AROUND THE GARDENS

That ornamental gardens can be hospitable habitats for birds becomes clear when one visits the formal gardens in spring. The 50 or more species of trees, shrubs and vines that grow here are supplemented by many varieties of flowering annuals. The trumpet vine attracts nectar-sipping birds like the Purple Sunbird which can be seen inserting its slender curved bill into the orange tubules, its iridescent body gleaming in the sun. The burbling call of the Red-vented Bulbul is heard everywhere while its elegant cousin, the Red-whiskered Bulbul, flies in and out of the maulsari trees. The Common Tailorbird and Ashy Prinia are little bundles of energy, constantly hopping and flitting between the cover of the shrubbery and open ground. Through the year, the Common Hoopoe and White Wagtail scour freshly watered lawns for insects while the Red-wattled Lapwing keeps vigil over its territory in the tennis courts. The Indian Peafowl, that most decorative of birds, minces across the grass with its voluminous train held off the ground, adding a picturesque note to the Mughal Garden.

On hot summer days, large numbers of birds looking for water converge on the fountains: the usual crowds of Rock Pigeon sometimes make way for an Egyptian Vulture or an Indian Peafowl that perches on the lip of the fountain, bending to drink while balancing its heavy tail behind. A White-browed Wagtail hops around on the edge of the fountain, seeking the stray insect larvae that survive the periodic cleaning of the water.

Like the formal gardens of the President's Estate, the bungalow gardens also provide valuable habitats for birds. The Purple Sunbird is a constant presence here, feeding on nectar from the chestnutleaf trumpet-bush, floss-silk tree and canna flowers, while the Ashy Prinia and Common Tailorbird usually make their homes in the hedges and bushy undergrowth. A bungalow garden on a sunny winter's day can keep a birdwatcher absorbed for hours as the Oriental Magpie Robin sings in the shrubbery, groups of Large Grey Babblers squabble noisily on the ground, parties of Rose-ringed, Plum-headed and Alexandrine Parakeets fly in and out of the trees, the Rufous Treepie sounds its melodious trill, the Black-rumped Flameback woodpecker dashes onto a tree trunk, and a





RIGHT:
Spotted Owlet

BELOW:
An Oriental White-eye hops energetically through a citrus tree looking for insects
[Photo credit: Brinda Datta]

RIGHT PAGE:
A Yellow-footed Green Pigeon on a mango tree in the Dalikhana



visiting Black Redstart flicks its tail in its characteristic tic. Looking up, it's hard to spot the flocks of Yellow-footed Green Pigeons in the dense canopy of pilkhan, banyan and goolar until they take off in a collective whoosh of wings. Surprisingly easy to see are Spotted Owlets which can be spied dozing on branches near their tree-hole nests in old karanj, mango and pilkhan trees; sensing a human glance, an owlet rapidly bobs its head up and down in righteous indignation.

Besides these fairly common birds, the gardens also host species that are seen less often in Delhi. In 2013, the rare Verditer Flycatcher was photographed near one of the larger bungalows, attracted to insects on the rotting fruit of a tree. On occasion, the Eurasian Thick-knee, camouflaged by its stillness and colours that blend into the background, emerges under the shade of a tree, even venturing out onto the lawn. The Oriental Honey-buzzard nests here. In winter, the Citrine Wagtail and White Wagtail leave their Himalayan breeding grounds and come down to the damp lawns, looking for food.









LEFT PAGE:
Alexandrine Parakeets
[Photo credit:
Ramki Sreenivasan]

ABOVE:
Male Plumheaded
Parakeet
[Photo credit:
Ashish Kothari]

LEFT:
Rose-ringed Parakeet
[Photo credit:
Ashish Kothari]



RIGHT:
Indian Grey Hornbills often fly in noisy parties of four or six, gliding from one fig-laden banyan or peepal tree to another

RIGHT PAGE ABOVE:
Egyptian Vultures are an endangered species and have all but disappeared from Delhi
[Photo credit: Garima Bhatia]

BELOW:
Black Ibis favour the watered fairways of the golf course where they find insects

THE GOLF COURSE & LAWNS

The green expanse of the golf course attracts many species of birds too. In summer, freshly watered lawns draw the Egyptian Vulture, Eurasian Collared Dove and groups of Black Ibis and Black Kite. Families of the Asian Pied Starling and Brahminy Starling also frequent the golf course, fighting over the choicest bathing puddles. In winter, migratory wagtails such as the Grey Wagtail, Citrine Wagtail and White Wagtail run about briskly chasing tiny insects. The avenue trees along the golf course and elsewhere also harbour their share of birds: the stately semal is used for nesting by the Black Kite and the Doon siris provides homes for the Common Myna, Alexandrine Parakeet and Indian Grey Hornbill. Groups of Indian Grey Hornbill can be spotted gliding from one tall tree to another.

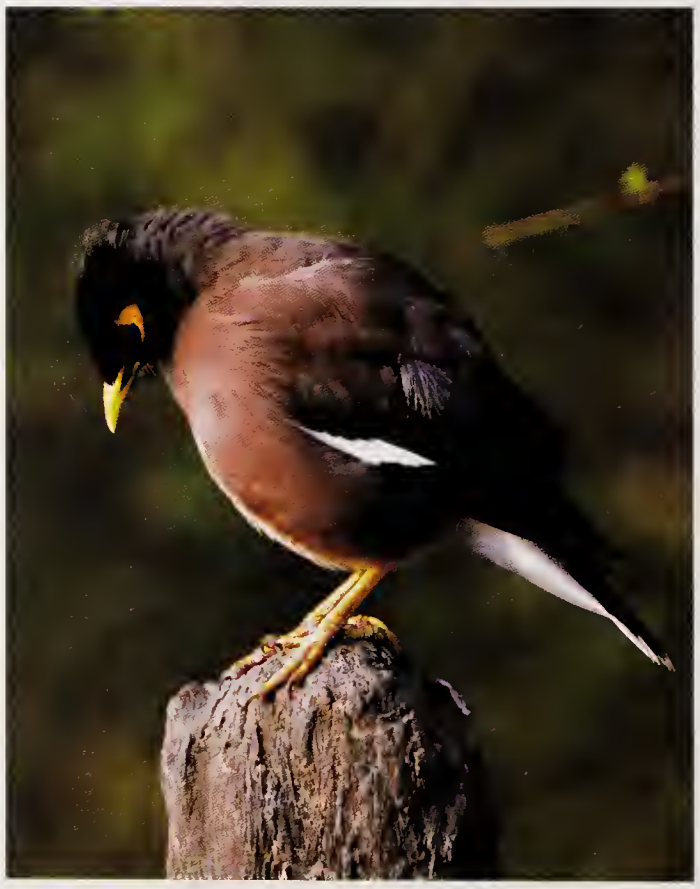






The Forecourt of the Rashtrapati Bhavan with its rows of massive laurel fig trees provides roosting places for thousands of birds every evening. Enormous flocks of Common Myna make a deafening din as they settle down for the night but are surprisingly hard to spot once they disappear into the dense tree cover. In autumn and spring, their numbers are supplemented by thousands of migrant Rosy Starling whose twittering calls can be heard until dusk.

The Rashtrapati Bhavan itself has a resident set of birds, besides the ubiquitous nuisance of the Rock Pigeon: the Alexandrine Parakeet uses the crevices in the walls for nesting, the Barn Owl waits in the shadows of parapets and on quiet balcony railings during its nightly hunts. The slender Dusky Crag Martin and the House Swift nest in tiny crevices along windows and in the eaves of the old buildings. During the day, they can be seen wheeling about the sky, hunting for insects on the wing.



ABOVE:
Rosy Starlings in the thousands roost in the Rashtrapati Bhavan trees in winter [Photo credit: Brinda Datta]

RIGHT:
Common Myna [Photo credit: Ashish Kothari]

RIGHT PAGE:
Barn Owls live near human habitation, emerging after dusk in silent, ghost-like flight [Photo credit: Supriyo Samatha]



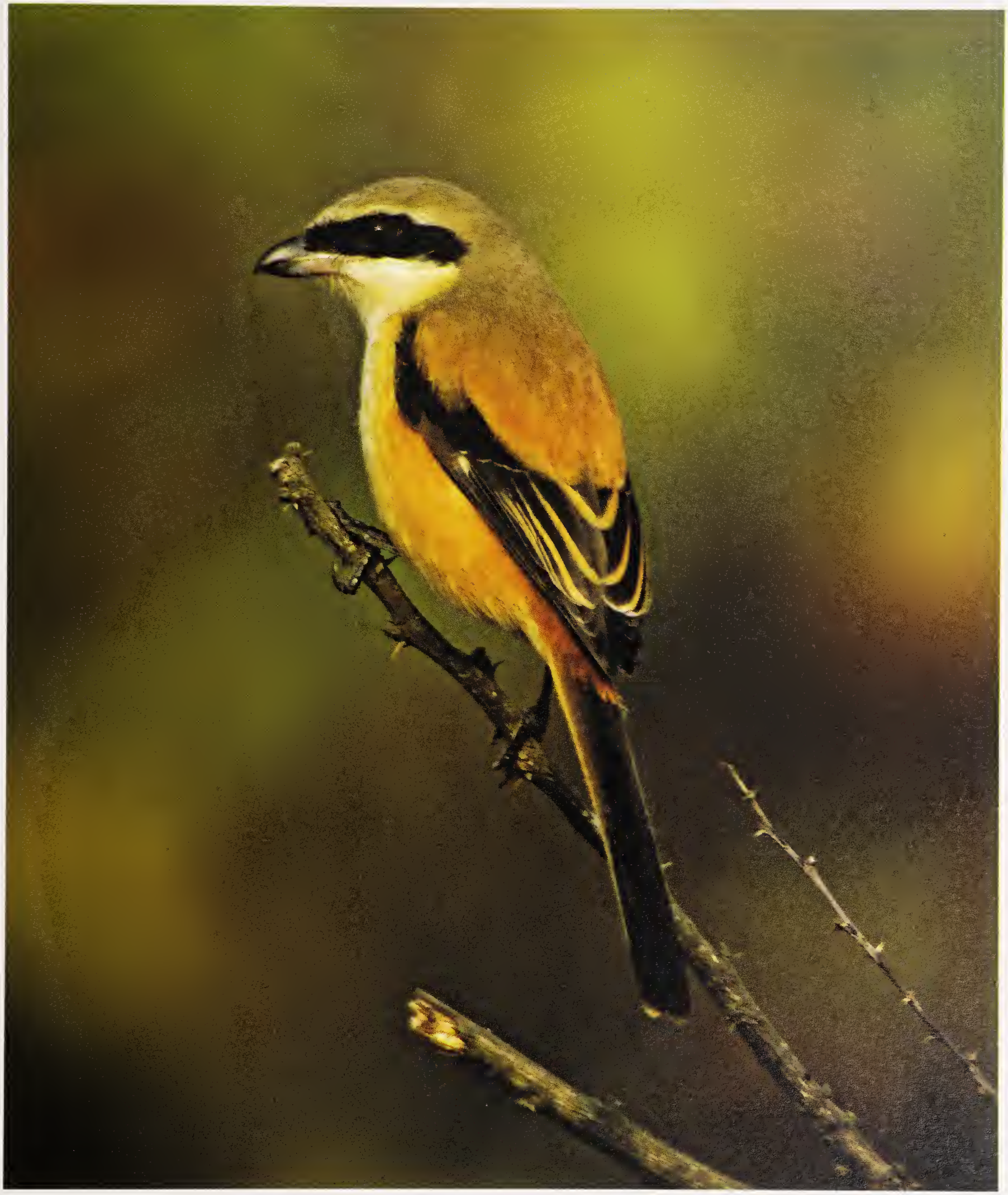


THE DALIKHANA AND ITS SURROUNDS

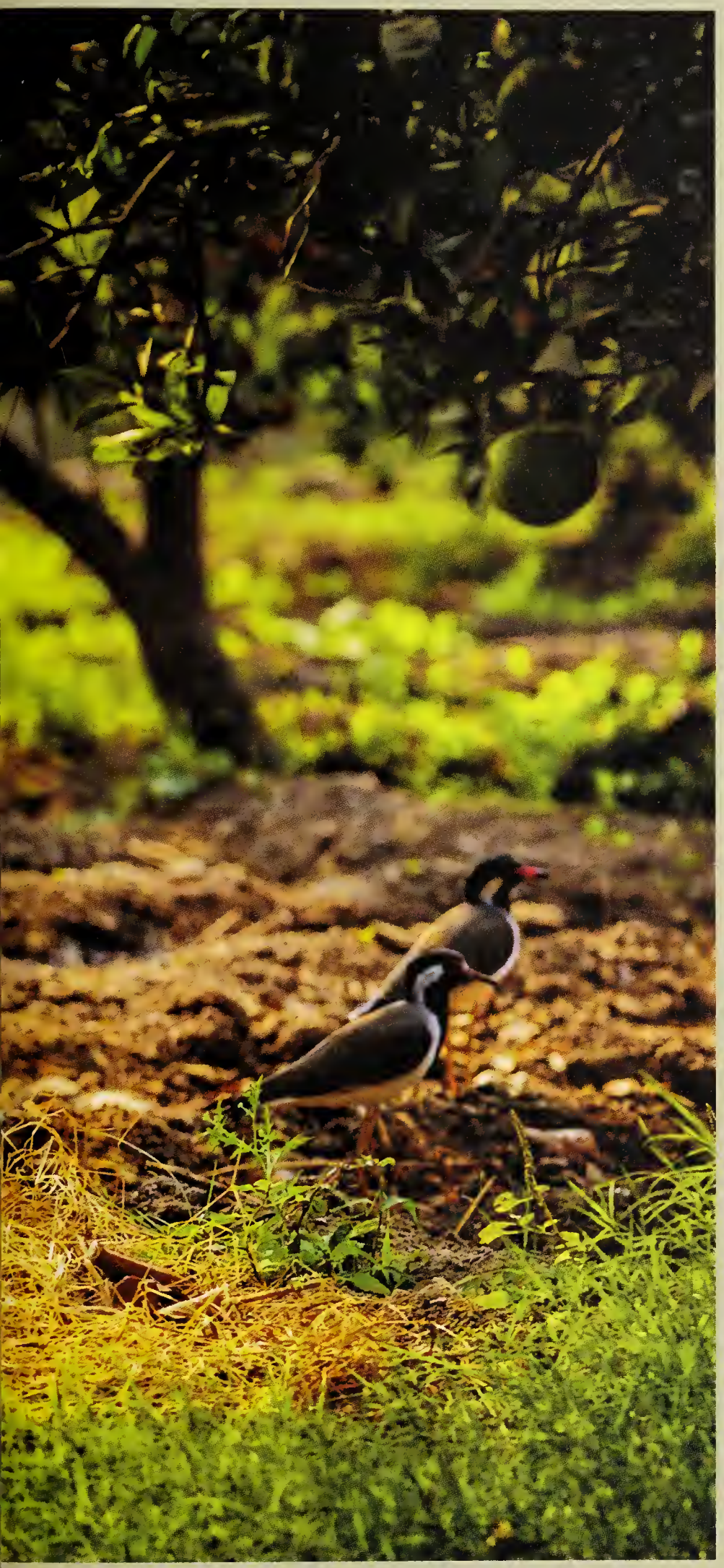
With its mix of vegetable beds and fruit trees, flowerpots and compost heaps, bordered by overgrown weedy plots and jungle patches, it is the Dalikhana that provides the most diverse habitat for birds within the President's Estate. The Cattle Egret and the Red-wattled Lapwing are among the common birds regularly seen in the vegetable fields. The Asian Koel, Indian Grey Hornbill, Coppersmith Barbet, Brown-headed Barbet and Yellow-footed Green Pigeon keep to the big leafy trees while the call of the Common Hawk Cuckoo can be heard in the background. The Rose-ringed, Plum-headed and Alexandrine Parakeets flock to feast on the guava, amla and anar fruit in the orchard. The Dalikhana is the place to spot birds rarely seen in the city, such as the Scaly-breasted Munia, Greater Coucal, Long-tailed Shrike and Blyth's Reed Warbler. These birds need relatively open habitats and are found in the more unkempt areas away from human disturbance. The male Baya Weaver, another uncommon bird in urban environs, was once spotted inspecting a grove of small trees for a nesting site. Grain-eating birds like munias, including the Indian Silverbill and the Scaly-breasted Munia, come for the seeds of grasses and bushes. The Common Stonechat, a winter visitor, is also partial to the grassy open areas of the Dalikhana. The compost heap in the Dalikhana is the place to see the Bluethroat, which flies from distant Europe and northern Asia, its pretty little form looking startlingly out of place on a heap of waste, however full of wriggling worms and crawling insects. The rare Verditer Flycatcher, a breathtaking blue, has also been seen in this area. The laid-back air of the sprawling Dalikhana, its scruffy edges and stillness, seem to offer these shy birds ample food and refuge.

ABOVE:
Male Baya Weaver
[Photo credit:
Suniti Bhushan Datta]

RIGHT PAGE:
The Long-tailed Shrike is a talented mimic, perfectly copying the squeals of a frog caught by a snake or the yelps of a newborn puppy
[Photo credit:
Ashish Kothari]







LEFT:
Red-wattled Lapwings under citrus trees in the Dalikhana; when alarmed, they fly away with a penetrating *Did-he-do-it?* call

BELOW:
Yellow-wattled Lapwing
[Photo credit: Garima Bhatia]







Birds of the field and grassland:

ABOVE:
Scaly-breasted Munia
[Photo credit: Brinda Datta]

RIGHT:
Red Avadavat
[Photo credit:
Ashish Kothari]

RIGHT PAGE:
Indian Silverbills, like the other munias on this page, go about in family parties, feasting on grass seeds in the Dalikhana





The Verditer Flycatcher is rare in Delhi but it can be spotted on the edge of the jungle and in the Dalikhana in winter
[Photo credit: Suniti Bhushan Datta]





ABOVE:
Common Stonechat
[Photo credit: Ashish Kothari]

LEFT:
The Bluethroat, a winter visitor from northern Europe, is seen near the vermicomposting heap, pecking at caterpillars and tiny beetles
[Photo credit: Ashish Kothari]



RIGHT:
Little Grebe
[Photo credit:
Ranjit Lal]

The pond in the Dalikhana, now doing double duty as a part of the newly installed sewage treatment plant, adds another dimension to the birdlife. A year-round water source surrounded by grasses and shrubs and overhanging trees, the pond is home to the Indian Pond Heron, Spot-billed Duck, White-breasted Waterhen, Common Moorhen, Little Grebe and the Purple Swamphen, birds that lurk in the vegetation for safety between their forays out on the water. A Spot-billed Duck family breeds every year in the pond. The frogs and toads, snakes and fish that live here are food for the fish-eating Indian Cormorant. The Black-winged Stilt and Green Sandpiper have been seen in the shallows of the pond while its tree-shaded edges host the tiny Red-throated Flycatcher and the Grey-headed Canary Flycatcher that fly short sallies over the water in pursuit of insects.



LEFT:
White-throated
Kingfisher
[Photo credit: Ranjit Lal]

BELOW:
Spot-billed Ducks in the
pond in the Dalikhana



RIGHT:
Indian Pond Heron
[Photo credit:
Suniti Bhushan Datta]

BELOW:
Green Sandpiper and a Grey
Wagtail near the pond
[Photo credit: Anjali Verma]

RIGHT PAGE:
Cattle Egrets are commonly seen
in the Dalikhana vegetable fields







THE JUNGLE & WOODED AREAS

The jungle patches around the Dalikhana harbour some uncommon birds such as the Common Woodshrike, Grey-breasted Prinia and Oriental Honey-buzzard which prefer environs undisturbed by human presence. In winter, they are joined by the Hume's Warbler, Greenish Warbler and Lesser Whitethroat, all species that need the security of dense vegetation. Searching the leafy canopy of vilaiti keekar and other trees, they manage to find prey even when insect life goes dormant during the coldest winter days. The Sulphur-bellied Warbler looks for insects among boulders and tree-trunks in the forest, behaving much like a woodpecker. In 2015, this warbler found a new place to forage amidst the dunes of hardened mud dumped during the building of a parking garage. The Spanish Sparrow and Chestnut-shouldered Petronia are often encountered in small chirpy groups at the fringes of the jungle and inside. The Grey Francolin, a quintessential edge inhabitant, ventures out amongst the flowerpots and vegetable beds in search of the odd titbit but scurries back into the safety of the forest when alarmed. The Rufous Treepie, Jungle Babbler and Black-rumped Flameback woodpecker are common in the forest too. The gorgeous Asian Paradise Flycatcher, one of the rarest birds in Delhi, has been seen only twice on the Estate during spring and summer. The silvery-white male, with its double ribbon-like tail streaming behind as it flies gracefully in search of insects in densely wooded areas, is likely to be nesting here.



RIGHT:
The Grey Francolin is often seen in grassy undergrowth looking for seeds and insects [Photo credit: Ashish Kothari]

RIGHT PAGE:
As its name suggests, the Oriental Honey-buzzard lives largely off honey and bee larvae [Photo credit: Nitin Srinivasamurthy]



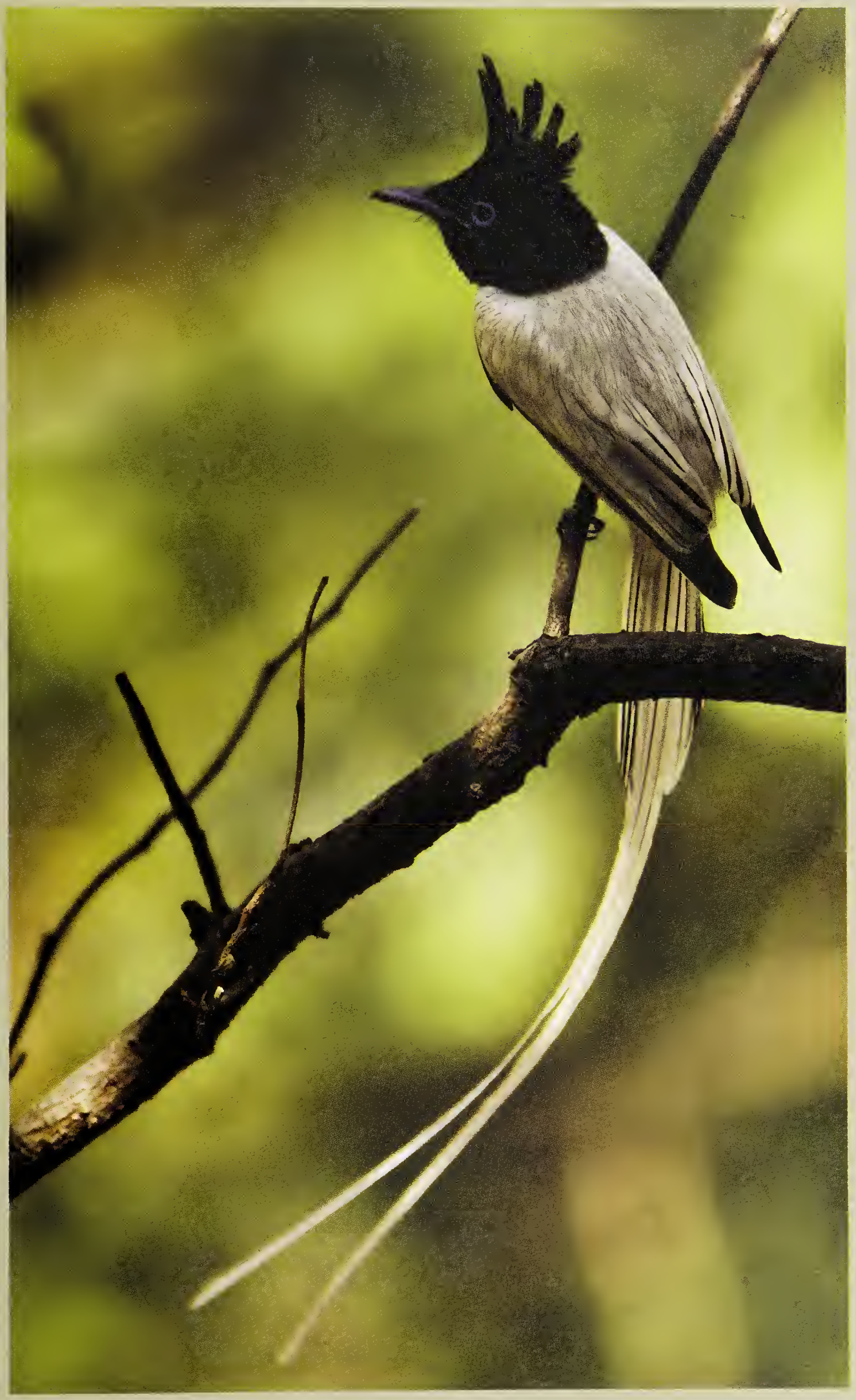
As the landscape changes with the seasons, the birds too respond to its ebbs and flows. When the Dalikhana pond overflows during the monsoon, it creates a swampy marshland around the adjacent forest patch and gardens. The insects that proliferate in this hot and humid environment attract insectivorous birds such as the Asian Paradise Flycatcher and the Grey-headed Canary Flycatcher. As it slowly dries up to reveal different substrates of mud, each with its own insects, amphibians and reptiles, other birds are drawn to it. These seasonal changes are as vital for birds as the diversity of spaces across the Estate. As green spaces in Delhi decline and become more homogenised, the Estate becomes all the more important for providing a rare combination of overlapping habitats. In particular, it continues to provide refuge to a number of birds that have disappeared from the city because they can no longer find undisturbed areas in which to feed, live and breed. The once ubiquitous Common Babbler and Common Hoopoe are among the birds that are still found on the Estate. Keeping alive the ecological niches that cater to the needs of such birds should be a key factor in managing wetlands, parks and forests within the President's Estate.





ABOVE:
The Grey-headed Canary Flycatcher is an active hunter, swooping and looping through the air in search of insects [Photo credit: Ashish Kothari]

LEFT:
The Common Babbler is, despite its name, rather uncommon in Delhi [Photo credit: Garima Bhatia]



The breathtaking Asian Paradise Flycatcher is very rare in Delhi but has been spotted on the President's Estate. The male is distinguished by its long ribbon tail feathers. [Photo credit: Garima Bhatia]

SURVIVORS IN THE CITY



ABOVE:
Rose-ringed Parakeet perched on a hollow in a neem tree
[Photo credit: Garima Bhatia]

When the landscape becomes more and more built-up and green areas disappear, so do most birds. However, some species have adapted comfortably to the seemingly inhospitable environment of the city. The flourishing numbers of the House Crow, Rock Pigeon, Black Kite and Rose-ringed Parakeet in Delhi testify to the resilience of these birds. Two factors seem to determine success in the city: being omnivorous and being unafraid to nest near humans.

The House Crow and Black Kite are efficient scavengers and feed off the waste that spills out of garbage dumps and elsewhere, swooping in the minute humans move away. Gangs of the House Crow will also harass other animals, including dogs, to keep them away. Pairs of House Crows can be seen chasing away adults of the Spotted Owlet and Shikra from their nests to get at the fledglings. Only the Asian Koel is reputed to have gotten the better of the House Crow: it lays its egg in the nest of the crow, tricking the latter into bringing up the interloper as its own offspring.

The original range of the Rock Pigeon was among cliffs and rocky hills in southern and western Europe, North Africa and South Asia but it now extends across the world. Domesticated more than 5,000 years ago as pets, Rock Pigeons were also trained to carry messages because of their strong homing instinct. Feral populations of these birds are well established in cities and towns where large numbers congregate wherever people put out grain for them to feed on. Their rocky cliff homes have now been replaced by nests on urban window ledges, ventilator shafts and *chhajjas*, from where their soft *gootr-goo* call is a constant accompaniment to everyday life. Fast breeders, they nest repeatedly in a year and multiply rapidly.

The Rose-ringed Parakeet has also homed in on human-made artefacts, nesting in the crevices of old monuments as well as in cavities in old trees.[7] The mature neem, siris, karanj and vilaiti keekar trees of Lutyens's Delhi, including the President's Estate, shelter thousands of these birds that arrow across the evening skies in flocks, their shrill cries floating down to earth. Although they will descend to eat the grain put down by charitable people in parks and gardens, they do not venture into more built-up environments, preferring greener spaces.



Keen-eyed scavengers and hunters, Black Kites are well adapted to city life



BIRDS & SEEDS

In a forest crowded with trees, getting away from one's parents can be critical for survival. Seedlings need sunlight which adult trees tend to shade out. Mature trees also harbour more pathogens and insect pests to which young seedlings are vulnerable. So to ensure reproduction, trees must produce seeds that can travel. Some encase seeds in pods that burst open and scatter their contents. Others endow seed cases with wings so that they can float away on the breeze. But the most common strategy for long-distance journeys is to make birds act as seed-bearers. Plants thus put their energy into producing fruit that birds (and mammals, including humans) can eat, fleshy nutritious packages in which the seeds are cleverly hidden. After visiting the tree and eating its fruit, birds fly away and defecate on the wing or where they perch, transporting the seed to a new location.[4] In some cases, the seed coat is softened by acids present in the birds' stomachs, thus increasing the chances of successful germination.

Ornithologists have studied hornbills, trogons, pigeons and barbets for their role in seed dispersal.[5] In some cases, they have found that specific plants and birds depend on each other for food and seed dispersal. If one partner in such mutualism fails, it can have serious consequences for the other. According to one theory, the tambalacoque, a tree endemic to Mauritius, gradually died out after the extinction of the dodo, a bird that would eat its fruit and process its seeds before dispersing them.[6] On the Estate, the Indian Grey Hornbill, the Yellow-footed Green Pigeon, Asian Koel and Brown-headed Barbet feed on the small soft fruit of putranjiva, banyan, peepal, neem and pilkhan that they swallow whole. The Red-whiskered and Red-vented Bulbuls love the glossy purple berry-like fruit of lantana and have enabled the shrub to spread all over the Estate, including inside the jungle patches. The Oriental White-eye has been spotted eating the fruit of the pania, which seems much too large for the throat of this tiny bird.

However, bird-plant relations are not always mutually beneficial. The Rose-ringed, Plum-headed and Alexandrine Parakeets eat and discard the unripe fruit of guava, ber, peepal and goolar, destroying the seeds before they mature.



LEFT:
The Asian Koel is heard more often than seen, here eating the figs of a banyan
[Photo credit: Gururaj Moorching]

LEFT PAGE:
An Indian Grey Hornbill eating peepal figs
[Photo credit: Ranjit Lal]



HUNTERS & SCAVENGERS

ABOVE:
A Shikra finds ample prey in the wooded jungle and gardens on the Estate
[Photo credit: Ranjit Lal]

RIGHT PAGE
ABOVE:
The fluty whistle of a Eurasian Golden Oriole alerts birdwatchers to its presence among the treetops
[Photo credit: Sumit Sen]

BELOW:
The Common Chiffchaff flies to Delhi from northern Europe and Asia
[Photo credit: Ashish Kothari]

With their acute eyesight for spotting prey from heights, powerful wings for swift flight, grasping feet with strong talons and hooked bills with a sharp cutting edge for tearing flesh, raptors are finely evolved for a predatory existence. Their powerful muscles enable them to catch prey far in excess of their body weight.[16] Their soaring habit, facilitated by warm thermal air currents that lift them up during the middle of the day, allows them to spot prey and offal that they can swoop down upon. Owls, with their silent flight and night vision, are well adapted to hunt at night.

As they sit on top of the food chain, these birds are exposed to higher concentrations of toxic chemicals that accumulate in the bodies of their prey. A study of Pallas's Fish Eagle found that even in protected areas such as Corbett National Park, DDT in fish eaten by the eagle resulted in lower viability of its eggs.[17] The Black-shouldered Kite used to be common around agricultural fields but has now become scarce in the northern countryside, probably because pesticides have decimated its snake and rodent prey populations. Most raptors have been affected by habitat loss and fragmentation. High-tension wires are a particular threat since they can get entangled in them.

Some hunter and scavenger species have adapted to humans. The Black Kite, for instance, has flourished on urban waste. However, changing human behaviour can be a problem too. Birds like the Egyptian Vulture, which feed on the carcasses left behind by pastoralist communities such as the Rabaris in Rajasthan, are threatened by the decline of such livelihoods. A widespread use of the anti-inflammatory drug Diclofenac for cattle resulted in the near-extinction of vultures all over India, due to its toxicity for their liver and kidneys.[18]

The common birds of prey recorded on the President's Estate include the Black Kite, Shikra, and Spotted Owlet. The Collared Scops Owl, Barn Owl, White-eyed Buzzard and Eurasian Eagle Owl are rare and have only been seen a few times.[19] The Shikra is often seen in the well-wooded parts of the Estate. It is a fast-flying falcon that eats rodents and reptiles. The Oriental Honey-buzzard specialises in eating bees and their larvae and has been observed tearing off pieces from honeycombs for feeding.

PASSERS-BY



While a large majority (1,006) of the 1,300 or so bird species recorded in the Indian subcontinent are residents, there are 159 visitors that primarily breed farther north and visit the region during winter.[8] When it gets cold, birds that breed in northern and central Asia during the summer fly south through Pakistan and the Indus plains, while birds from north-east Asia are believed to follow the Brahmaputra and its tributaries into the subcontinent.[9] Many Himalayan birds are altitudinal migrants, breeding in the upper reaches of the mountains and descending to winter in the foothills and peninsular plains. Some resident birds, too, are seasonal migrants and move locally within the Indian subcontinent. These



seasonal migrants often track the progress of the monsoons, taking advantage of the insect abundance that follows in their wake; the Eurasian Golden Oriole, Indian Pitta and Asian Paradise Flycatcher are among the birds that do this.

Twenty-five migratory bird species have been recorded on the Estate. These include the elusive Lesser Whitethroat, Grey Wagtail, Hume's Warbler and Common Chiff-chaff. These birds move between the cultivated and wild parts of the Estate and can be seen in and around the jungle. Passage migrants such as Verditer Flycatcher, Tickell's Blue Flycatcher and Ultramarine Flycatcher alight in the Estate to feed en route to their final destination. Gregarious passage migrants such as the Rosy Starling also show up during March-April and August on their journeys to and from their wintering grounds in peninsular India. During those weeks, the karanj avenue trees resound with their noise every evening when they settle to roost after a day spent feeding in agricultural fields and around Delhi.

THE INSECT EATERS



RIGHT:
The Green Bee-eater makes graceful sallies after bees and other insects that it then batters to death and swallows
[Photo credit: Ashish Kothari]

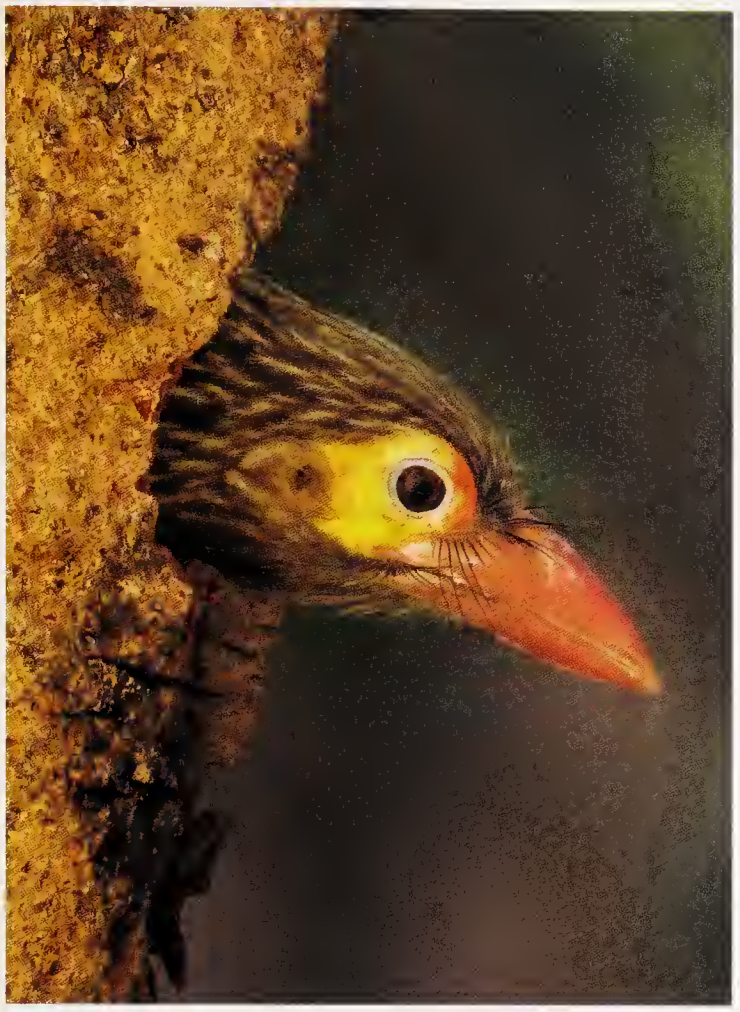
Among all birds, it is the species that eat insects that are most vulnerable to changes in their habitat.[10] Woodpeckers and nuthatches, which glean insect prey off tree-trunks and nest in tree cavities, are gradually disappearing as the large old trees in forests are dying. Canopy feeders such as leaf warblers, flycatchers, minivets and cuckoos need dense foliage which is harder to come by since many forest trees have been heavily lopped and felled, especially around human settlements. A study in Sariska Tiger Reserve in Rajasthan found that insect-eating birds such as Great Tit, Oriental Magpie Robin, Eurasian Golden Oriole, Oriental White-eye, Tickell's Blue Flycatcher and White-browed Fantail Flycatcher have disappeared from areas that are heavily used by local villagers for collecting firewood and fodder and for grazing livestock.[11] Even forests away from human settlements are less hospitable to birds since the diversity of natural vegetation has been replaced by commercially valuable single species plantations which harbour fewer insect species and thus far less food for birds.

BELOW:
Tickell's Blue Flycatcher
[Photo credit: Ashish Kothari]



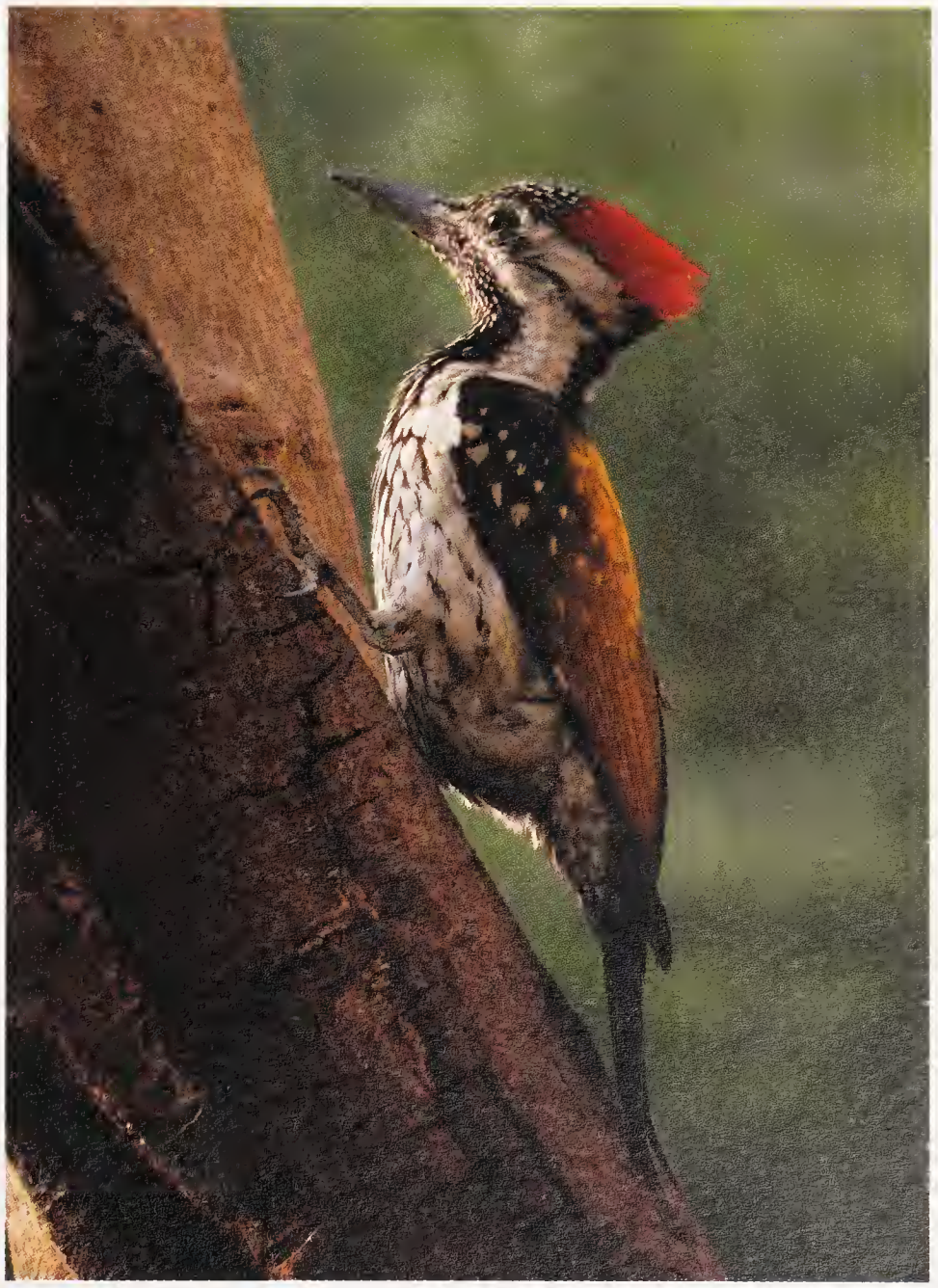
Many birds commonly seen in and around agricultural fields, such as the Indian Roller, Black Drongo and Long-tailed Shrike, are decreasing as a result of chemical-intensive agriculture.[12] Increased pesticide use has poisoned birds as well as their insect prey, while fewer fallows, hedges and forest remnants in agricultural areas have shrunk their habitat. However, in regions such as the rain-fed districts of Uttar Pradesh where farming is still done the more traditional way, bird diversity continues to be high.[13]

Within Delhi, the President's Estate is notable for its high diversity of insect-eating birds. The presence of many large old trees along avenues and in gardens, the pond, the tangled jungle as well as extensive fallows and neglected undergrowth around the Dalikhana combine to create a happy habitat for the Sulphur-bellied Warbler, Greenish Warbler, Hume's Warbler, Common Chiffchaff and Lesser Whitethroat. Sometimes in winter one can see several species of warblers, prinias, flycatchers and babblers hunting together in mixed flocks where they take advantage of each other's activity to capture more insect prey.[14] Maintaining the mosaic of ecosystems is crucial for fostering birdlife on the Estate.



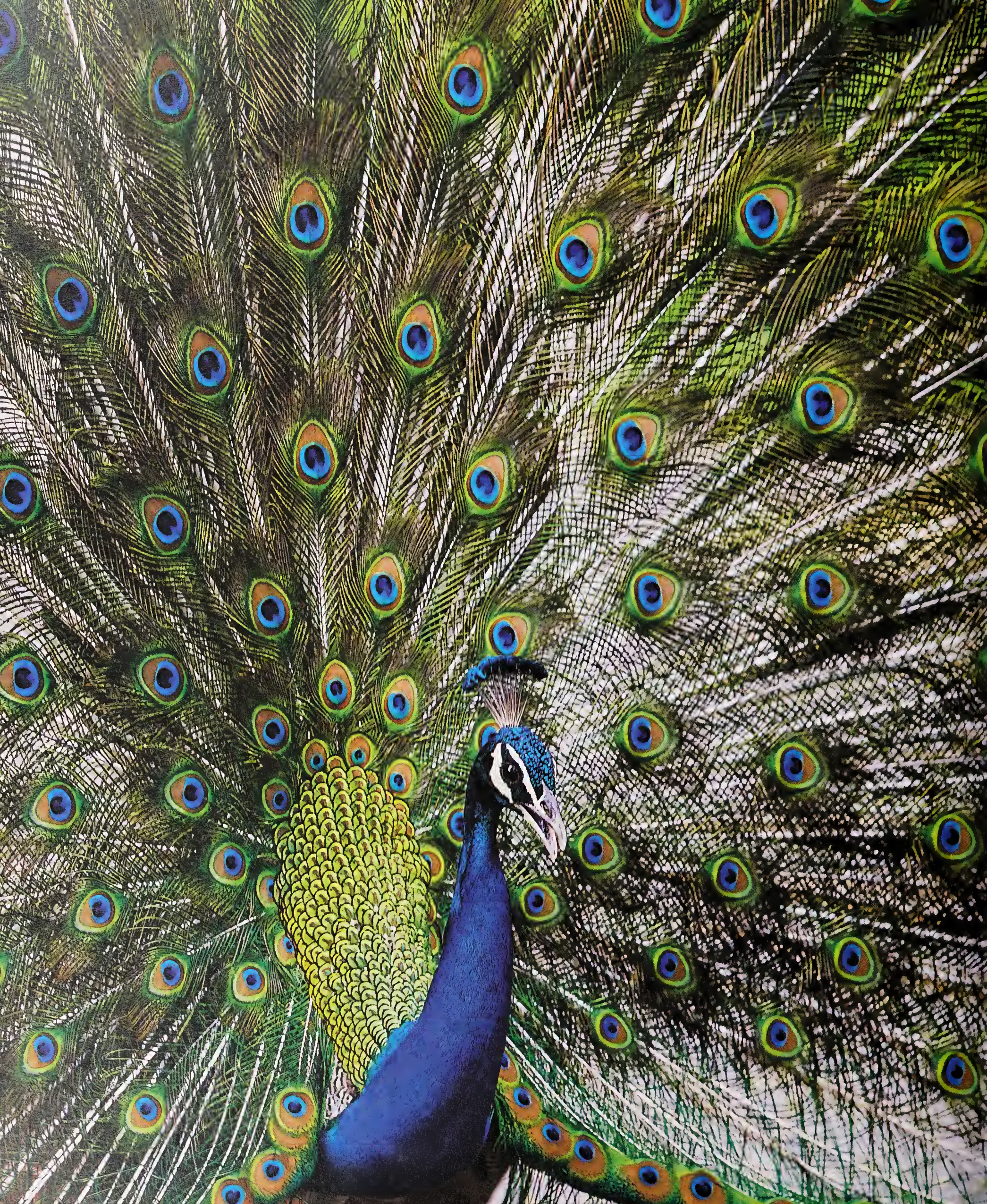
LEFT:
The Brown-headed Barbet uses its heavy beak to excavate holes in rotten tree branches and boles
[Photo credit: Brinda Datta]

BELOW:
Black-rumped Flameback
[Photo credit: Brinda Datta]



ECOSYSTEM ENGINEERS

Birds that make holes in trees for nesting have been dubbed 'ecosystem engineers' because their abandoned cavities provide space to many other birds, mammals and reptiles. Different species of woodpecker use different types and sizes of trees, but most require large, dead or decaying trees. Since people usually take away deadwood from forests, most woodpecker species thrive only in relatively undisturbed forests; hence they are regarded as indicators of good forest quality.[15] On the Estate, the Black-rumped Flameback is the woodpecker that creates tree cavities. The other common cavity excavator here is the Brown-headed Barbet with its heavy beak. The holes that these birds make, as well as those that occur naturally, are used for nesting by the Indian Grey Hornbill, Alexandrine Parakeet, Rose-ringed Parakeet, Spotted Owlet, Common Myna and the Five-striped Palm Squirrel. The Indian Grey Hornbill has been seen fighting with birds like the Common Myna and Rose-ringed Parakeet over nesting cavities. Reptiles like the Common Wolf Snake are known to occupy tree cavities for resting and preying on fledgling birds.

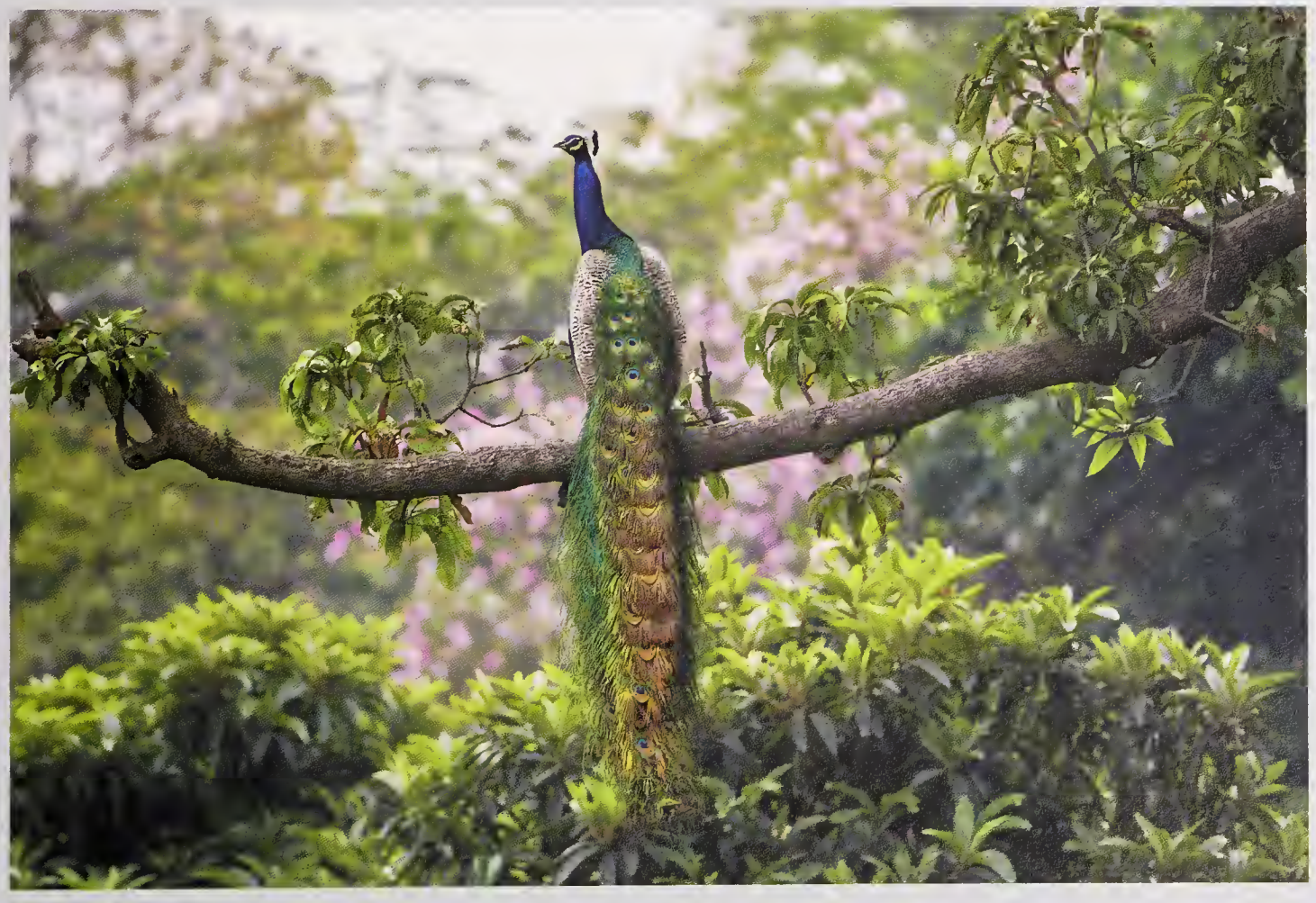


THE PEACOCK'S TAIL

The Indian Peafowl, the largest member of the pheasant family, is probably the one bird that any Indian child can recognise. Found only on the Indian subcontinent, its size and splendour have made it an icon since ancient times. In popular culture, *morpankhi* refers to the silky turquoise colour of the peafowl's neck; its tail feathers with their arresting 'eyes' have long been used for adornment, especially in association with the god Krishna's headdress, while Sufi shamans use them to drive away evil spirits. The courtship dance of the male when it unfurls its tail into a spectacular quivering fan is a sight to behold.

Why does the male Indian Peafowl have such an elaborate tail? While the males among many birds display strikingly coloured plumage or perform elaborate courtship rituals to attract females, isn't the heavy tail of the male peafowl a liability when it comes to flying and manoeuvring around predators and prey? A theory called the 'Handicap Principle' proposes that the 'enormous cost a peacock incurs by carrying its elaborate and weighty tail-feathers, which interfere with movement and flight, reliably communicates its quality and desirability as a mate'.[20] That is, the well-dressed male seems to be saying: I have survived in spite of this cumbersome tail, so I must be fitter and more attractive than others.

The Indian Peafowl is native to the drier parts of India and is partial to open deciduous woodlands and scrub forests. It is unusual among pheasants for being rather tolerant of people, thriving around villages as long as there are sufficient tall trees for roosting and dense shrubbery to nest in.[21] On the President's Estate, the Dalikhana's vegetable beds, orchards and unkempt edges provide plenty of young shoots, worms and fruit for the peafowl, while small reptiles, rodents and insects abound in the scrub forest. Peafowl are also often seen in the Mughal Garden and in the adjoining enclosure for deer, turkeys and geese, eating the bread and grain provided for the menagerie.



chapter seven

Seasons

THE CYCLES OF LIFE

GHAZALA SHAHABUDDIN

Delhi is situated in the semi-arid biome of the Indian subcontinent, an area of ecological transition between the Thar desert and the Gangetic plains. So the city's climate is largely dry: it receives about 70 to 80 cm of rain each year,[1] nearly all of it during the monsoon in July and August.

> Delhi lies a little over 200 metres above mean sea level … Its insularity, far away from the sea and nudging the western desert region, [along with] latitude (28° N), … makes Delhi scorchingly hot in summer, with temperatures touching 46°C in May and June. In winter, even if it never quite goes down to freezing, Delhi grows cold enough to cause some plants to wilt and die. Fog and mist in winter too causes sufficient loss of sunlight to make a difference to plants.[2]

Such wide variations in temperature, rainfall and humidity favour plants that can survive prolonged drought and heat. Delhi's natural thorn forests, for instance, have trees and shrubs such as ronjh, khair and sickle bush that can ride out the long summer into the short concentrated burst of monsoon rain. Many other native trees in Delhi are deciduous: trees such as dhak, doodhi, chamrod, bistendu, pilkhan, peepal and kosam drop their leaves probably to minimise the loss of moisture during the driest period of the year in late January-early February, four months after the monsoons have ended.[3] They rapidly grow new leaves within a few weeks, often just after flowering, and their seeds are produced and dispersed in time to germinate during the monsoon. Because of these seasonal rhythms, thorn and dry deciduous forests are also called 'monsoon forests'. Many commonly cultivated trees, such as neem, kachnar, semal, karanj, shisham, subabool and shahtoot, also turn bare in February-March.

While many trees shed their leaves, some adapt to drought by growing deep roots to tap into subsoil water, or by developing glossy leaves or fleshy stems that minimise moisture loss. Such adaptations also enable shrubs of the thorn forest such as heens, karaunda and kareel to stay green through the long drought. Trees such as khirni, laurel fig, putranjiva, saptaparni and kamini are among those that renew their leaves through the year, though a gentle peak of leafing does take place in spring and again in the monsoon.

Fauna, too, adapt their biorhythms to take advantage of the changed conditions in each season. For insects and birds, breeding activities are tuned to times of plenty, mainly spring and monsoon, when there is ample food for the young. Mammals give birth in the late summer or monsoon, by which time their major prey have had time to build up their populations. Many cold-blooded animals such as reptiles and amphibians, however, become inactive in the heat of summer, hibernate in winter, and confine their breeding to the monsoon season.



THE RAINS

AFTER THE blinding heat of the summer, the coolness that the rain brings is welcomed by all. The daily range of temperatures stays between 27°C and 35°C. The high humidity, fluctuating between 50–90 per cent, is extremely conducive for animal and plant life. Most of the rain is concentrated in the months of July to September, with the heavier downpours restricted to July and August.

In a naturally water-scarce region such as Delhi, even a minute increase in ambient humidity can trigger leafing in trees, shrubs and herbs. By the end of the long summer, when the monsoon is but a hint in the air, many plant species begin to sprout new leaves in anticipation of the rains to come.

The formal gardens are highly managed environments, and the gardeners have to fight back fast-growing weeds and leafing trees at this time of the year. The maulsari, morpankhi and Italian cypress trees stand formally against brilliant green lawns refreshed by the rains while the curtains of tall putranjiva trees on the edges of the garden provide a lush backdrop.

Yet, even in this manicured environment, wild fauna manages to find a foothold. The untidy orange-red flowering canna, commonly planted in this season, provides hiding places for spiders, ants and brilliantly coloured Leaf Beetles. Many of the maulsari trees are infested by moth caterpillars, against which the gardeners wage a losing battle. A number of dragonfly species including the orange Rock Glider and the striped Green Marsh Hawk are attracted to the Mughal Garden's water channels and puddles. Every now and then, a dragonfly lightly dips the tip of its tail into the water surface to lay eggs on submerged vegetation, before gliding away. Butterflies such as the Lemon Pansy, Lime Butterfly, Common Crow, Common Mormon and the Plain Tiger flit around busily. Mixed swarms of brightly coloured butterflies indulge in mud-puddling when patches of soil in the flowerbeds are soaked by the rains.

PREVIOUS PAGE:
Old and new leaves of a pilkhan. [Photo credit: Brinda Datta]

ABOVE:
Canna leaves and flowers in the Mughal Garden shelter small spiders, beetles and ants





ABOVE:
Mud-puddling Common Gull butterflies suck up soil minerals
[Photo credit: Dhruv Pal]

LEFT:
The hairy spines on a Tussock Moth caterpillar are extremely irritating to the skin



ABOVE:
Courtship between Indian Peafowl
[Photo credit: Ashish Kothari]

RIGHT PAGE:
Pied Cuckoo or Papiha, symbol of the monsoon
[Photo credit: Nitin Srinivasamurthy]

Male Indian Peafowl, their splendid plumage flickering at full mast, use the Mughal Garden to display themselves to prospective mates who, however, seem curiously inattentive to their charms.[4] The air is pierced by their plaintive calls, occasionally punctuated by the shrill alarm cry of the Red-wattled Lapwings that nest near the tennis courts adjacent to the formal gardens, protesting against the gardeners and security staff who cross their territory. Red-whiskered and Red-vented Bulbuls seem to be everywhere, perching on taller trees to broadcast their intricate territorial calls. A special treat at this time of year is the melodious but raspy call of the Papiha or Pied Cuckoo, a monsoon visitor from East Africa, as it flies into the dense canopy of the maulsari trees to feed on moth and butterfly caterpillars. The small but loud Ashy Prinia, Common Tailorbird and Purple Sunbird find nesting sites in the dense creepers and shrubs here and elsewhere on the President's Estate.

All day long, from the shady gardens on the Estate, comes the *kudruk-kudruk* call of the Brown-headed Barbet and the hollow ring of the Coppersmith. The Asian Koel is conspicuous during the monsoon, synchronising its breeding with that of birds such as the Common Crow whose nests it parasitises.





ABOVE:
A Chalcid Wasp feeds on a sprig of khair blossoms

At this time, the motley collection of trees in the Spiritual Garden provides a veritable feast for insects. A flowering sapling of khair throbs with activity as Chalcid Wasps, Cuckoo Wasps, Chafer Beetles, Leaf Beetles, Flowerflies, bees and butterflies, such as the Common Silverline, Blue Tiger and Plains Cupid, crowd around the flowers to feed, mate and fight off competitors. Some beetles, true bugs and spiders seize this opportunity to ambush prey. Butterflies also linger on the solitary flowering sandalwood tree nearby, drunk on nectar. The grassy lawn, difficult to keep neatly mown during this time, is sometimes covered by batches of freshly emerged Net-winged Beetles. The tulsi patch in full bloom is a special draw for insects such as the Cuckoo Wasp, Carpenter Bee and Pioneer Butterfly.

The kitchen garden grows rather unkempt during the monsoon as grasses and herbs spring up everywhere. In this luxuriance thrive plant-feeding insects such as grasshoppers, butterflies and aphids, mating and laying eggs. The explosion in insect numbers, in turn, is the trigger for birds such as Jungle Babbler and Ashy Prinia to begin nesting as they need enormous quantities of insects to feed their voracious fledglings. The Small Indian Mongoose, garden lizards, skinks and geckos hide in the weedy surrounds to pounce on tasty morsels of caterpillars, true bugs, young grasshoppers and crickets, and insect eggs. Spiders lurk in dark corners and under shady leaves, waiting to capture their share of the spoils. Female spiders can also be seen scuttling around with their egg sacs.

Dung Beetles busily roll out balls from macaque dung and take them to their underground larders with astonishing speed. A memorable event during the monsoon is the swarming of winged termites, especially after a heavy overnight shower. Only during the breeding season does one see thousands of 'kings' (reproductive males) and 'queens' emerge from their natal nests, find each other, mate, and set up new colonies underground. One can only watch in wonder as hordes of these insects squeeze themselves one after another from tiny nest-holes in the ground, somehow managing to keep their delicate wings





ABOVE:
Blue Tiger butterfly
[Photo credit:
Ghazala
Shahabuddin]

LEFT:
Net-winged Beetles
proliferate on the
lawns in the rainy
season



RIGHT:
A Cattle Egret stalks through the undergrowth in the Dalikhana in search of insects

BELOW:
Blister Beetle on a pumpkin flower



intact. The exodus from nest-holes can sometimes last for an hour. Since the kings and queens are also full of nutrition, large numbers of opportunist feeders throng the site. At one such swarming event in September 2014, a mongoose family with two babies, several peafowl, Common Mynas, Black Drongos and Red-vented Bulbuls were fighting each other for the luscious treats, picking termites off the nest-holes almost as soon as they emerged, or catching them in the air in expert sallies. Even large birds like Black Kites were attracted to the bonanza and soared above the spot, quick to swoop down on unwary prey.

The massive old jackfruit trees in the kitchen garden shelter birds such as the Yellow-footed Green Pigeon and the Indian Grey Hornbill. Unripe fruit in the orchards of mango, guava, orange, bael and pomegranate offer rich pickings to parties of Rose-ringed Parakeets, Asian Koels and Brown-headed Barbets. Closer to the ground, the vines of cucurbits such as bottle gourd, zucchini, bitter gourd, snake gourd and pumpkin are festooned with yellow and white flowers that attract pollinators like gaudy Blister Beetles, large black Carpenter Bees and the fast-flying Conjoint Swift Butterfly. The flowers of the sonjna tree attract the Praying Mantis, and their subtle fragrance draws moths at night. The leaves of the ladies' fingers and brinjal plants are soon riddled with holes chewed by insects.



ABOVE:
Cuckoo Wasp on a pumpkin flower

BELOW:
Snake gourd flower

In the monsoon, the forest patches come alive with *Pierid* butterflies, particularly the Yellow Orange-tip, the Small Orange-tip, the White Orange-tip, the Pioneer and the Large Salmon Arab. All these species lay their eggs on heens, the most common thorny green bush, so that their caterpillars can feed on its new leaves. Once they emerge, the butterflies feed on the flowers of a multitude of understorey shrubs such as kamini, and low-growing herbs such as sida and kalaghavani. Butterflies such as the Common Crow, Common Mormon and Plain Tiger are also seen in this season, though they are far scarcer compared to other butterflies, here and elsewhere on the Estate.

The dense recesses of the forest patches teem with detritivore species such as termites, roaches and millipedes which feed on dead plants and animals. The most noticeable among the scavengers are the ants, scurrying to and fro, transporting bits of dead animal matter to feed their gigantic colonies and, in the process, facilitating the work of decomposers such as fungi. The rainy season sees bracket fungus growing on rotting tree branches and mushrooms erupt from the ground. Drenched by the occasional heavy downpour, the soil is alive with micro-flora and micro-fauna, busy decomposing living matter back into its basic elements. Together, the detritivores and decomposers ensure that no organic matter is left untouched and that all the nutrients in the ecosystem are recycled.

The quiet of the forest patches is broken by parties of noisy Jungle Babblers, Large Grey Babblers and the equally gregarious Grey-breasted Prinia. Indian Grey Hornbills call a lot in this season and can be seen in groups of two to four, moving around the canopy, probably nesting in cavities in some of the biggest trees. The Shikra and the Oriental Honey-buzzard too use the forest as their hideout though they are frequently seen in other shady groves, tall trees and planted gardens. Sometimes, groups of Oriental White-eyes are seen foraging in the large karanj trees at the edge of the forest. A *ki-ki-ki* announces the presence of the Black-rumped Flameback, the glowing golden-and-red woodpecker that frequents the Estate, as it flies from one tree to another.

The monsoon is also a good time for birds near the man-made pond in the Dalikhana. Brimming with water and overhung with large old trees of peepal, neem, mango, and maharukh, it provides a perfect habitat for birds. During this season, the peepal tree is often full of Yellow-footed Green Pigeons which come to gorge on its clusters of small black fruit. Their colour blends so exactly with the green of the leaves that their presence is betrayed only when they fly away. Water birds such as the Spot-billed Duck, Indian Pond Heron, Little Egret, the Common Moorhen and White-breasted Waterhen make their homes here in the weedy patches and bushes adjoining the pond and feed in the algae-ridden water of the pond. In the still afternoon heat of the monsoon, families of Rhesus Macaques sometimes refresh themselves by jumping into the pond from the overhanging trees and then swimming back to the edge.

Otherwise elusive reptiles and amphibians become more active and easier to spot during the rainy season. Snakes, skinks, geckos, lizards, frogs and toads concentrate their egg-laying during this time due to the abundance of insect prey. Bouts of heavy rain bring out Ratsnakes that may be flooded out of their burrows. The Striped Keelback, a water-loving snake, is spotted occasionally in and around the pond, often using aquatic plants as a perch to attack and devour lesser prey such as tadpoles. This mildly poisonous snake is commonly overlooked because of its tiny size

BELOW:
Small Orange-tip butterfly
[Photo credit: Ghazala Shahabuddin]

RIGHT PAGE:
The humid monsoon weather is ideal for fungi like these











and its brown and yellow stripes that blend into the shrubbery and grass.

The Dalikhana pond overflows into the surrounding woodlands during the rains, creating a number of temporary puddles and ponds. Two other ornamental ponds have also been recently built beyond the northern edge of the Dalikhana pond to showcase aquatic life. All these small water bodies come alive with a variety of frogs, toads and snakes during the monsoon. Surprisingly, the Common Bullfrog and Common Indian Toad, reported to be the most common amphibian species in Indian towns and cities, are seen only occasionally on the Estate. Instead, the Indian Marbled Toad, named for the pale warty patches on its body, can be found everywhere. The Ornate Narrow-mouthed Frog, barely 2.5 cm long, is much rarer; it lives on trees and shrubs, well camouflaged by its green and brown pattern. Another species that is sometimes spotted in this season is the Indian Burrowing Frog, named after its habit of rapidly digging itself into mud with the help of spurs on its hind legs when it encounters a threat. Toads and frogs live off the larvae of mosquitoes, frogs and other aquatic insects which proliferate in the water enriched by organic debris from the surrounding trees, shrubs and grasses.

As the monsoon progresses, the temporary puddles and pools in the Dalikhana become arenas for frenzied breeding among the Indian Marbled Toads. Emerging from their burrows around midnight, they gather in the weedy cover by the water's edge until they deem it safe to come out in the open. Then a reverberating croaking chorus starts up to attract females. Once enough females have gathered, males attempt to mount them. The females can be seen hopping around with the males riding piggyback for hours; some collapse with exhaustion! After a few weeks, thousands of tadpoles swarm in the puddles, providing a rich source of food for birds and snakes.

LEFT PAGE:
Indian Marbled Toads are very active around the Dalikhana during the monsoon, calling to attract females and mating
[Photo credit: Anjali Verma]

BELOW:
Buff Striped Keelback





AUTUMN

BY OCTOBER, the monsoon gradually gives way to drier weather. The first hints of approaching winter are the cooler mornings and evenings, though the rest of the day can still be rather hot and humid, with the temperature going up to 33°C. Morning temperatures are usually a pleasant 19°C in October, going down further to an average of 13°C in November. If monsoon is the time of burgeoning animal life, autumn is when many trees and shrubs burst into blossom.

The tree-lined avenues are colourful at this time — the mauve hues of jarul, the only conspicuous splash of colour during the monsoon, giving way to the gaudy yellow blossoms of the chestnutleaf trumpet-bush. Bougainvillea in shades of orange, purple and pink brightens the streets and gardens. The robust kassod is also crowned by large clusters of yellow flowers. Along the golf course, the elegant Doon siris trees, with their distinctive pale bark, put forth white powder-puff blossoms around this time. The most eye-catching, though, are the floss-silk trees growing near the auditorium, bare but for their bright pink flowers that last until late October. Their nectar attracts swarms of large Rock Bees and many Purple Sunbirds fighting to get at the best flowers.

The ber trees that dot the orchards and kitchen gardens begin to flower in early autumn. The flowers are an inconspicuous greenish-yellow, their mild fragrance discernible only at close quarters in the evening. But their nectar draws a surprising variety of insects — Paper Wasps, Dwarf Honey Bees, Potter Wasps, Flowerflies and even beetles such as the Ladybird Beetles, Net-winged Beetles and Chafer Beetles. Butterflies such as Yellow Orange-tip, Striped Pierrot, Common Gull and Lime Butterfly also flock to drink in the bonanza.

One fragrance that pervades the evening autumn air, like an overdose of spicy aftershave, is that of

ABOVE:
The chestnutleaf trumpetbush is a staple along Estate avenues

RIGHT PAGE
ABOVE LEFT: Purple Sunbird feeding on a floss-silk tree

ABOVE RIGHT:
Doon siris blossoms

BELOW:
Floss-silk tree outside an Estate bungalow







saptaparni. Clusters of its pale green flowers advertise themselves thus to moths, and perhaps even bats, around the Estate. Another scent, localised and sweet, is that of the harshingar whose pretty orange-stemmed flowers open at dusk and, by morning, drop to the ground in a carpet of white and orange stars.

By October, many trees are full of fruit. The Spiritual Garden's massive shisham tree, laden with nutritious seedpods, attracts an army of Rhesus Macaques trying to stuff several seed pods into their mouths at one go. The best pods are cornered by the dominant males while the females and young squabble over the leftovers. The amla, arjun, kaim, yellow oleander and guava are also full of young fruit. The Indian Grey Hornbill and the Alexandrine Parakeet flock to the goolar and guava, but the greatest tax on the guava orchards is imposed by the Rose-ringed Parakeets. To save some part of the produce from their beaks, the gardeners wrap plastic bags around clusters of fruit.

Around the Dalikhana, the continued abundance of insects allows congregations of birds such as the Red-whiskered Bulbul, Red-vented Bulbul, Coppersmith Barbet, Indian Grey Hornbill, Rose-ringed Parakeet, while a Shikra may silently watch to see if it can catch one of the smaller birds. The Dalikhana pond dries to just a layer of squelchy mud in October, ideal for shorebirds like the Black-winged Stilt and the Green Sandpiper which need only a shallow sheet of water for their foraging. The resident White-breasted Waterhen and Common Moorhen make do with the reduced water levels though they can no longer swim. But the pond still has plenty of dragonflies which hover above in a whirling cloud, as numerous now as they were immediately after the rains. The bright yellow, blue and green Coromandel Dart Damselfly flickers in and out of the short weedy vegetation around the pond.

In the forest patches, even as the weather turns colder, butterflies like the Yellow Orange-tip, White Orange-tip and Lemon Pansy still flit around in the bushes. Jhinti and vajradanti, two perennial shrubs that go on flowering right through winter, provide much-needed nectar during this period of scarcity. Tucked away at ground level are smaller herbs and shrubs such as chitrak and atrilal that produce tiny flowers on which these smaller butterflies continue to feed. The



RIGHT:
Coromandel Dart Damselfly

RIGHT PAGE:
Chafer Beetle and ant feeding on ber flowers





availability of host plants and the warm days allow butterfly species like the Common Grass Yellow and Common Mormon to go through a second generation in October-November. Butterflies like the Common Castor can be seen flitting around the tall castor plants which grow in the weedy patches in the Dalikhana. The Lime Butterfly still frequents the citrus orchards, occasionally alighting upside-down to lay eggs on the underside of a leaf within seconds. Damselflies and dragonflies can still be seen in mating pairs, indicating continued breeding.

The first sights and sounds of migrant winter birds begin in early autumn. The rough *t-rrr* of the Lesser Whitethroat can be heard in the forest, from where it rarely ventures out. Puddles and ponds and the fountains in the Mughal Garden attract the Grey Wagtail. The elegant Black Redstart is a regular visitor too. The chirruping call of the Grey-headed Canary Flycatcher and the two-note chirp of the Hume's Warbler in the forest are a definite heralding of winter, though they can be seen only by keen-eyed and patient birdwatchers.

Night-walks and hidden cameras reveal a world concealed from most eyes. Flocks of the Indian Fruit-bat or Flying Fox can be seen flapping through the Estate at dusk, feeding on goolar and pilkhan and the other fruit available in this season. Blyth's Horseshoe Bats whirl around the streetlights, catching insects on the fly. Jackals warily step out of their forest refuge to forage for fallen amla fruit and ripening vegetables in the kitchen garden. Sometimes they are accompanied by their pups that are born in the summer.[5] Spotted Owlets chuckle from the transmission wires, competing with the bats for nocturnal insects. Moths are much more elusive, however, and can only be seen after a long vigil at a flowering ber or harshingar tree.



ABOVE: Common Castor butterfly
[Photo credit: Dhruv Pal]

RIGHT:
Autumn's early morning carpet of harshingar flowers

RIGHT PAGE:
Leaves of castor in the monsoons and in winter
[Lower photo credit: Brinda Datta]







WINTER

WINTER ARRIVES IN earnest once the tentative bursts of cold and mist become more frequent, usually by the beginning of December. In December and January, the minimum temperature can drop as low as 3°C, though on the average, minimum temperatures stay around 8°C. In some years, the temperature can reach freezing point too, particularly in the open outskirts of the city. During the day, the temperature goes up to a pleasant 21–22°C, on the average. Smoggy, overcast days are interspersed with sunny spells.

In the forest, the ambience is dank and cold and tree leaves are covered with a thick layer of dust. The canopy still remains green, but the leaves of the vilaiti keekar begin to thin. Many other deciduous trees such as chamrod and bistendu also begin to shed leaves in response to winter. Annual herbs in the understorey vegetation start to die down by November and only perennial shrubs like heens and jhinti stay green. Vilaiti keekar bucks the general rule among trees by flowering in early winter, with some trees even bearing ripe pods by January. Lantana, an escaped ornamental that is now an invasive pest across India, blooms on the edges of the forest patches and, like the cultivated annuals flowering in the gardens, sustains the dwindling insect population.

In this season, only mammals and birds remain active due to their ability to internally regulate their body temperature. Cold-blooded creatures such as reptiles, amphibians, insects and spiders are either dormant or hibernating. Surprisingly, however, several species of dragonflies stay around until early December. Some butterflies, such as the Small Orange-tip, are hardy and use the warmth of the sunlit patches in the forest to display themselves for mating. The Plain Tiger butterfly uses lantana blossoms and flowering weeds such as goat weed to sustain itself. These exceptions apart, insects and other cold-blooded animals tend to disappear in winter.

Yet, even in this time of diminished food, birds seem to thrive.





ABOVE:
Plain Tiger Butterfly

LEFT:
Skipper Butterfly on lantana



RIGHT:
Red-throated Flycatcher
[Photo credit:
Ashish Kothari]

BELOW:
Purple Sunbird feeding
on aak flowers
[Photo credit:
Garima Bhatia]

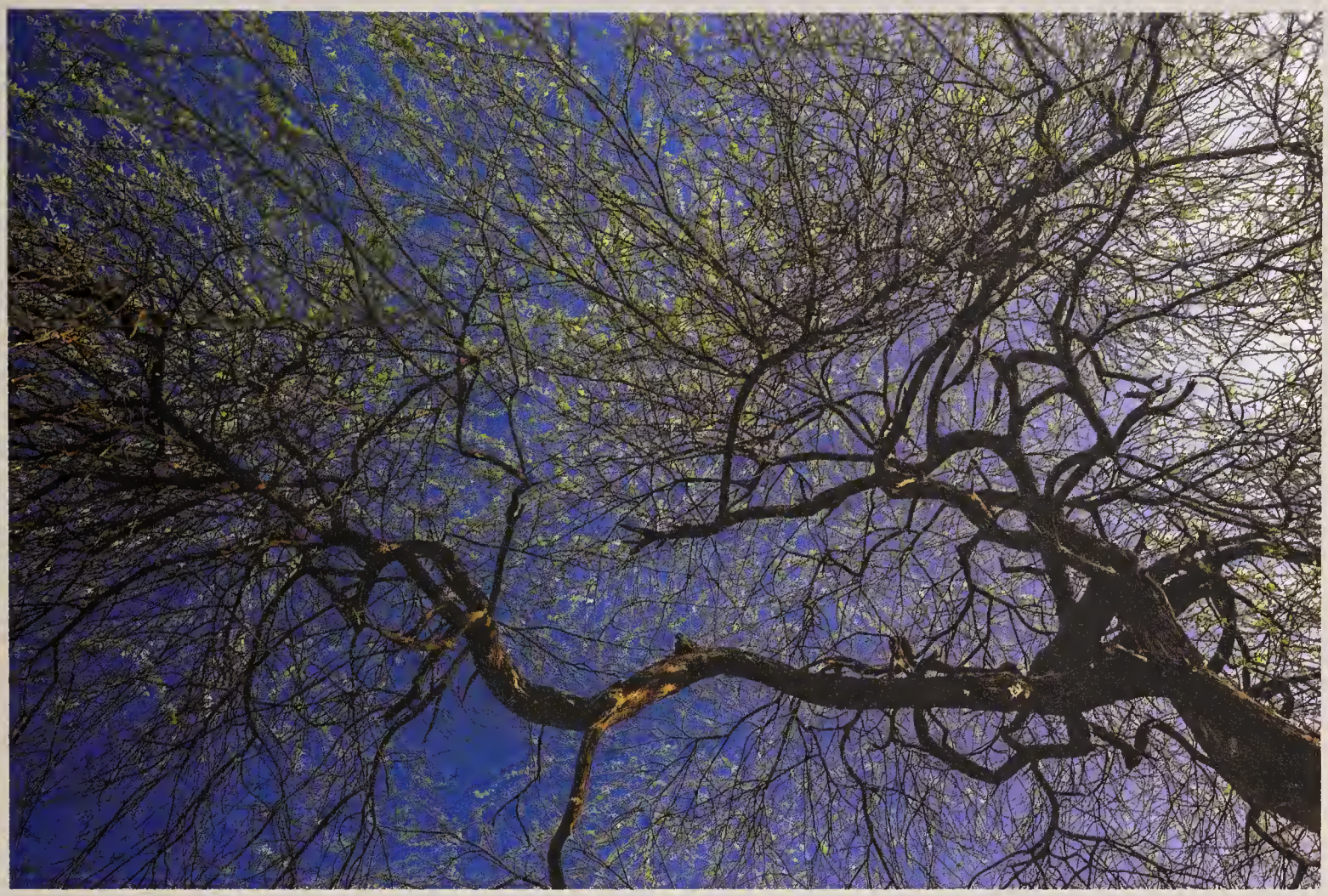
RIGHT PAGE
ABOVE:
Vilaiti keekar is unusual
among trees for
flowering in early winter

BELOW:
Kosam and other
deciduous trees shed
their leaves in winter

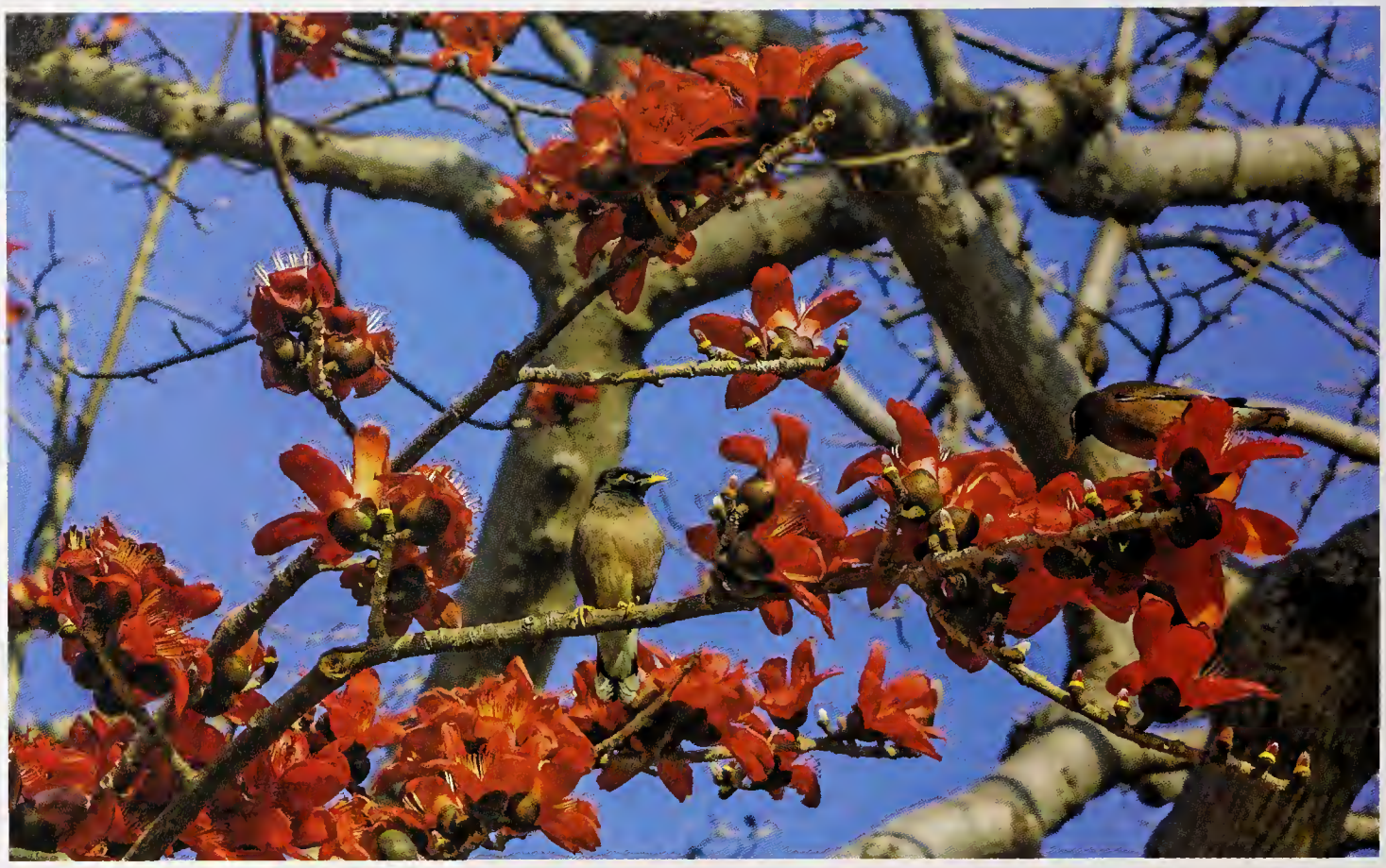


Oriental Magpie Robins and Jungle Babblers poke around in the leaf litter and on bare tree branches. The forest periodically resonates with the bass whoop of the Greater Coucal, the metallic trill of the Rufous Treepie, and the urgent queries of the Grey Francolin. Migrants such as the Lesser Whitethroat, Common Chiffchaff and Hume's Warbler find shelter and food — primarily insects — in the trees and grasses. The Sulphur-bellied Warbler, also a winter visitor, methodically searches tree trunks and rocks for its insect prey. The shrubs and creepers on the edge of the sewage tank atop a rise in the forest host visitors such as the Red-throated Flycatcher and Hume's Warbler.

More than the forest, it is the cultivated grounds of the President's Estate that provide a variety of food for birds in winter. Ripe ber and amla in the Dalikhana attract Rose-ringed Parakeets, Alexandrine Parakeets and even Indian Grey Hornbills, which otherwise rarely descend this low in the canopy. The figs of the peepal trees scattered across the Estate draw these and other birds and insects.The more open habitat of the Herbal Gardens becomes home for the migratory Black Redstart and even, oddly enough, a vagrant Eurasian Thick-knee, which is usually found in open scrub, desert or stony tracts. In the medicinal plant beds, sarpagandha berries are a ripe red, and shatavari and gheekumari are in flower. Purple Sunbirds feed and drink nectar from the flowers of aak.







SPRING

IN EARLY FEBRUARY, cold grey days start giving way to sunny warm ones. Evenings continue to have a nip in the air, but clear blue skies signal the onset of spring. Morning temperatures are 10°C on the average in February, going up as high as 15°C in March. By the end of March, however, daytime temperatures can go up to 29°C, bringing a foretaste of the summer to come.

Quick to sense the change in temperature and day length, trees like shahtoot, vilaiti keekar, phulai and khirk burst into new leaf. Tender green colour brightens the dark canopy of older foliage, deepening its hue as spring progresses. Later in the season, the bare pilkhan trees along the golf course and around the formal gardens put out a shimmering array of copper leaves that turn gold and then green. The twin rows of kosam trees near the Dalhousie Road entrance to the Estate bear leaves of such a bright red that, from a distance, they seem ablaze with flowers. Yet other trees such as the khair, kassod, semal and maharukh begin to drop their leaves in the early days of spring, to be regained quickly by mid-summer.

As if competing with the exuberant display of flowering annuals that crowd the gardens and roadside beds on the President's Estate, several trees put forth spectacular floral displays. In March, the bare limbs of the Caribbean trumpet trees along the golf course burst out with blinding yellow flowers. In the kitchen gardens, the solitary bush of din-ka-tara is resplendent with perfumed white tubular flowers and, in the orchard, masses of orange blossoms exude a delicate fragrance. The white and pink blossoms of kachnar look even brighter against the blue sky, while the stately semal is covered in plump red flowers and crowded with birds competing for nectar. An old palash near the formal gardens burns a bright orange. By April, the moulmein rosewood trees at one end of the golf course are covered in a delicate mauve mist. A few jacaranda trees briefly spread a purple canopy before it is time for the gulmohur. In the football field, the fruit of a tall wild almond tree has been ripening through the winter and now the pods crack open to reveal seeds that attract Rose-ringed Parakeets, Rufous Treepies and Green Pigeons.

ABOVE:
A flowering semal tree is a feast for insects and birds such as this Common Myna

RIGHT PAGE:
Caribbean trumpet tree







Springtime sees the pilkhan run through a range of colours once its bare skeleton begins to put out new leaves



RIGHT:
Kachnar tree in flower

BELOW RIGHT:
Dudhi ki bel

BELOW LEFT:
Kachnar blossoms
[Photo credit: Brinda Datta]

RIGHT PAGE:
Dhak in flower













ABOVE:
Maerua oblongifolia
[Photo credit: Pradip Krishen]

BELOW:
Flowers of the coral creeper attract several butterflies and other insects

The forest, too, comes alive with flowering trees, shrubs and climbers during springtime. Yellow dust from the blossoming vilaiti keekar drifts down to the ground. Hitherto inconspicuous climbers such as arni, *Maerua oblongifolia* and dudhi ki bel, and herbs such as chitrak and kanghi bloom exuberantly. Clusters of white star-like flowers on the chamrod, the gently scented blossoms of gondni, adulsa and kadi patta give butterflies a plenitude of food. Many butterfly species also feed on the pink flowers of the coral creeper that grows on the edges of the forest.

Many insects experience a second population boom during spring when plants grow tender new leaves. The open spaces in the forest are filled with the flutter of butterflies looking for food and mates. Pioneer Butterflies lay large batches of eggs on the tips of fresh heens leaves on which the future larvae will feed. Newly-emerged butterflies are everywhere; one can come close to a young Lime Butterfly as it sits with its open wings drying before taking off on its maiden flight to find nectar. The migrant Painted Lady can be seen swiftly darting around the kitchen garden.

Birds become more vocal in the spring as they seek nesting spots and mates. The incessant calls of the Brown-headed Barbet and the Coppersmith can be heard everywhere on the Estate. Usually shy birds like the Yellow-footed Green Pigeon come into view as they engage in courtship displays and nesting activity. The Indian Grey Hornbills become unusually vocal too, flying from tree to tree to check out cavities for nesting, even trying to evict parakeets from the spots that they like! In response, the parakeets duck inside in the cavities, emerging only after the encroaching hornbills have left. The latter are occasionally seen engaging in territorial fights with other hornbills, fighting beak to beak. Pairs of the Black-rumped Flameback can also be seen checking out holes on tree trunks which they can hollow out and deepen for their nests.

The forest plays host to uncommon visitors such as the turquoise-blue Verditer Flycatcher and the Ultramarine Flycatcher, passing through Delhi on their way back from peninsular India to their breeding grounds in the Himalaya. Another passage migrant is the Rosy Starling; at dusk and dawn, the chittering sounds of thousands of these birds fill the khirni and karanj avenue trees where they roost together for the night.



ABOVE:
Lime Butterfly on a rosy periwinkle blossom

Gulmohur row near the north Herbal Garden



SUMMER

WITH THE MAXIMUM temperature fluctuating, on the average, between 35°C and 39°C, and some days in June witnessing temperatures as high as 45°C, summer in Delhi is a trying time for most creatures and many plants. The heat is dry and humidity fluctuates between 20 per cent and 40 per cent from April to June. Dusty loo winds sweep the city, cresting occasionally into storms with a spatter of rain that brings a brief respite from the heat. But at the peak of summer, even the greenery of the Estate is not enough to cool the air at night.

Yet, there are trees that flower even at these harsh temperatures. Along the streets and in the gardens, vivid gulmohur and amaltas shine bright. In the Herbal Gardens, the maroon flowers of the sausage tree hang low, within easy reach of the bats that pollinate them. In the forest, heens bushes are still in flower. The vanilla scent of their flowers leads one to the doodhi trees that are scattered through the forest. Meanwhile, the kanju is already laden with biscuit-coloured papery discs encasing its seeds, softly rustling in the occasional gust of wind.

The onset of summer is signalled by the call of the Asian Koel, a low *kuoo* that rises in scale until it reaches fever pitch, only to break off abruptly. Below the trees in which the Asian Koel and Common Hawk Cuckoo hide, well-watered lawns create oases for Black Ibises and Black Kites. Seen in pairs or groups of five during the rest of the year, as many as fifteen Black Ibises have been seen together on the golf course. Sometimes one can also see the Egyptian Vulture here, a sight to savour now that vultures have almost disappeared from Delhi.

ABOVE:
Five-striped Palm Squirrel feeding on amaltas flowers
[Photo credit: Brinda Datta]

BELOW:
Red-whiskered Bulbul cools off
[Photo credit: Vaidehi Gunjal]





The Dalikhana pond, along with its neighbouring smaller water bodies, remains a refuge for amphibians and reptiles during the summer. Its water level has now been augmented by outflow from the new sewage treatment plant, which is also used to water the kitchen garden and orchards. A Ratsnake can be spotted gliding out of the Dalikhana pond, possibly after fishing for prey. These reptiles sometimes hide out in the cool of the airy underground galleries of termite mounds. Brahminy Worm Snakes live in the moist leaf litter and mud of the wooded areas around the pond. For the same reason, they are often seen in flowerpots as well.[6] The ponds also attract insects such as Rock Bees, damselflies, Blue Tiger Butterflies and dragonflies, though they are fewer in number during this season. At twilight, Blyth's Horseshoe Bats emerge from their daytime roosts in the



abandoned bunkers and ruins in the forest and swoop over the water, gathering up mosquitoes and flies.[7] In the strands of algae in the water, hungry dragonfly nymphs chase after vulnerable young tadpoles. A dragonfly adult emerges from its last nymphal stage in infinitesimally slow moves, leaving its moulted skin behind on a spinach plant at the water's edge.

Most amphibians and many species of reptiles are nocturnal in summer for the intense daytime heat can damage their metabolic systems. A night walk through the forest thus reveals a fascinating hidden world. A number of Brook's Geckos and Spotted Supple Skinks skitter across the leaf litter on the forest floor looking for insects. Other insectivores such as the House Shrew nose around for termites near their mounds. Centipedes with golden yellow legs move swiftly in search of prey which, for the larger centipedes, can include much larger animals such as bats and mice which they sting to death. A Common Wolf Snake, as thick as a finger and a foot in length, slinks in hot pursuit after the Brook's Gecko, which forms the major portion of its prey.[8] This strictly nocturnal species lives in rock crevices and has been spotted in abandoned buildings in the forest. The same habitat shelters scorpions that wield their fearsome claws and painful sting to attack their prey. The muted rustling and creaking sounds of a summer night hint at unseen dramas as predators and prey play hide and seek.

Each season brings drama, colour and perfume to the President's Estate. Nature lovers are constantly rewarded with beauty as well as insights into the web of life that exists around us.

ABOVE:
Common Wolf Snake

LEFT PAGE
ABOVE:
The tanks of the sewage treatment plant are a refuge for dragonflies in the summer

BELOW:
Brook's Gecko
[Photo credit:
Vishal Prasad]

NOTES

CHAPTER ONE
Introduction: First Garden of the Republic

1. Charles Hardinge, My Indian Years, 1910–1916: The Reminiscences of Lord Hardinge of Penshurst (London: John Murray, 1948), 72. Robert Irving notes that 'Hardinge had favoured the southern site as early as March 1912, when he sought a view of it by climbing the monumental eighteenth-century observatory built by the Maharaja of Jaipur. The site had struck him as 'distinctly good'. Robert Irving, Indian Summer: Lutyens, Baker, and Imperial Delhi (Delhi: Oxford University Press, 1981), 51.

2. Edwin Lutyens to Lady Lutyens, 9 June 1912. Archives of the Royal Institute of British Architects.

3. Second Report of the Delhi Town Planning Committee, quoted in Irving, 52.

4. Letter from Hardinge to Edwin Lutyens, August 19, 1912. Quoted in Pradip Krishen, Trees of Delhi: A Field Guide (Delhi: Dorling Kindersley, 2006), 37.

5. Gazetteer of Delhi District (Lahore, 1912).

6. R.N. Parker, "Afforestation of the Ridge at Delhi," Indian Forester January (1920): 25.

7. Nayanjot Lahiri, "Delhi's Capital Century (1911–2011): Understanding the Transformation of the City," Paper presented at the Agrarian Studies Colloquium, Yale University, 4 March 2011, http://agrarianstudies.macmillan.yale.edu/sites/default/files/files/colloqpapers/20lahiri.pdf (accessed on June 14, 2015). Lahiri notes that the residents of Raisina were resettled in Bhogal (p. 16). No trace of the village remains today but for the shrine of a pir by one of the remaining jungle patches on the Estate.

8. Krishen, 37.

9. From an experimental plot of 242 acres in 1916, the area planted had grown to a 1,000 acres by 1929.

10. As Krishen points out, this failure was probably because foresters miscalculated ecological conditions: '... even the driest parts of UP's sub-Himalayan forests are a lot wetter than the Ridge. The trees chosen were simply unsuitable for the Ridge' (Krishen, 38).

11. Walter George, "The Roadside Planting of Lutyens' Delhi," Urban and Rural Planning Thought April (1958): 86.

12. Parker, 25.

13. Irving, 226.

14. The biodiversity that this wilderness harbours is discussed in Chapter 5, this volume.

15. Another use for the Ridge was suggested by Herbert Baker, who proposed that the area be quarried to create a Durbar amphitheatre, which would also yield raw material for roadfill and concrete. However, this was rejected as being too expensive (Irving, 262).

16. Parker, 26.

17. Irving, 241.

18. Patrick Bowe, "'The Genius of an Artist': William R. Mustoe and the Planting of the City of New Delhi and its Gardens," Garden History 37, no. 1 (Summer 2009): 76.

19. W.R. Mustoe, Superintendent, Government Agri-Horticultural Gardens, Lahore, Notes upon Roadside Arboriculture (Lahore: Government Printing, 1915), cited in Bowe, n.11, 78.

20. Bowe, 68.

21. Ibid., 71.

22. Edwin Lutyens to Lady Lutyens, 17 January 1929. Archives of the Royal Institute of British Architects.

23. Edwin Lutyens to Lady Lutyens, 31 January 1929. Archives of the Royal Institute of British Architects. Quoted in Eugenia W. Herbert, Flora's Empire: British Gardens in India (Philadelphia: University of Pennsylvania Press, 2011), 265.

24. Quoted in Herbert, 264–65. The formal gardens are discussed in more detail in Chapter 2, this volume.

25. The 'garden city' was a model proposed by Ebenezer Howard in 1898 to address the problem of overcrowding in Britain's industrial cities. It envisaged an urban plan organised as a series of concentric circles bisected by boulevards, with a business hub, and residential areas surrounded by open spaces and public parks. Ebenezer Howard, Garden Cities of Tomorrow (London: Faber and Faber, 1902 [1946]).

26. The avenue trees of the Estate are discussed in Chapter 3, this volume.

27. The utility garden is discussed in Chapter 4, this volume.

28. Irving, 226. Old habits die hard: even today, although the garden staff is much smaller, one worker is assigned solely to picking vegetables for the President's kitchen every day.

29. This style of landscape gardening, identified with Capability Brown (1716–83), its best-known practitioner, continued to be popular in England for more than 200 years.

30. H.Y. Sharada Prasad, Rashtrapati Bhavan: The Story of the President's House (New Delhi: The Publications Division, Ministry of Information and Broadcasting, 1992), 90.

31. Ibid., 101.

32. Quoted in Sharada Prasad, 101.

33. Prime Minister Nehru suggested that part of the Estate be given over to market gardening to cover the high labour cost of maintaining the gardens, but Lord Mountbatten said that the income would not be enough. (Letter from Lord Mountabatten, 8 May 1948, C. Rajagopalachari papers, File no. 60, Nehru Memorial Museum and Library).



34. Jagpal, Head Mali, interviewed on 17 September 2014.

35. http://www.hindustantimes.com/newdelhi/rashtrapati-bhavan-sets-trend-for-eco-friendly-township/article1-438727.aspx (Accessed on 27 June 2015).

36. http://timesofindia.indiatimes.com/city/delhi/ISO-certificate-for-green-Rashtrapati-Bhavan/articleshow/6216467.cms (Accessed on June 27, 2015).

37. Herbert, 271. This was in keeping with the practice of stately homes in Britain to host 'open days' when the public could tour the building and gardens usually closed to them.

38. Ram Singh, Mali, interviewed on 29 September 2014.

39. Herbert, 271.

40. Bowe, 77.

41. We can be sure that it would have been witheringly sarcastic: this was the man who, upon seeing the British buildings of the Public Works Department in Simla, said, 'If one was told the monkeys had built it all, one would have said what wonderful monkeys! They should be shot in case they do it again.' Quoted in Sharada Prasad, 29.

CHAPTER TWO
Formal Gardens: English Flowers in an Islamic Charbagh

1. Penelope Hobhouse, Gardens of Persia (London: Cassell Illustrated, 2004).

2. C.M. Villiers-Stuart, Gardens of the Great Mughals (New Delhi: Cosmo Publications, 1913 [1983]), 10–11.

3. Saba Risaluddin, The Quest for Paradise: Gardens, Past, Present and Future (New Delhi: Niyogi Books, 2013).

4. Baburnama, the book of his memoirs, was written in Chaghatai Turki. It was translated into Persian during Akbar's reign.

5. Over time, this name was corrupted to Ram Bagh, which is how the garden is now known.

6. Villiers-Stuart, 101.

7. Ibid. 99–100.

8. Lady Beatrix Stanley, "Gardening in India," The Gardeners' Chronicle 23 May (1931).

9. Emma Roberts, Scenes and Characteristics of Hindostan, with Sketches of Anglo-Indian Society (Philadelphia: Carey, Lea & Blanchard, 1836), quoted in Eugenia W. Herbert, Flora's Empire: British Gardens in India (Philadelphia: University of Pennsylvania Press, 2011), 61.

10. Edith Cuthell, My Garden in the City of Gardens (London: John Lane, 1905), quoted in Herbert, 48.

11. Herbert, 42–44.

12. Richard Drayton, Nature's Government: Science, Imperial Britain, and the "Improvement" of the World (New Haven, CT: Yale University Press, 2000).

13. Herbert, 47.

14. Mrs. R. Temple-Wright, Flowers and Gardens in India: A Manual for Beginners, 4th ed. (Calcutta: Thacker, Spink, 1898), quoted in Herbert, 49.

15. The Anglo-Saxon lawn fetish was transplanted in all the colonies, including North America and Australia, where there are now steadily growing gardening movements to get rid of this water- and chemical-intensive import. See Paul Robbins, Lawn People: How Grasses, Weeds, and Chemicals Make Us Who We Are (Philadelphia: Temple University Press, 2007).

16. Villiers-Stuart, viii.

17. Ibid., 279.

18. Ibid.

19. Herbert, 262.

20. Christopher Hussey, The Life of Sir Edwin Lutyens (London: Country Life, 1950), 272. Quoted in Herbert, 262, and Patrick Bowe, "'The Genius of an Artist': William R. Mustoe and the Planting of the City of New Delhi and its Gardens," Garden History 37, no. 1 (Summer 2009): 73.

21. However, the slope of the land was too slight to include the terraces from the Ridge that Lady Hardinge wanted.

22. Quoted in Herbert, 261, 262.

23. Gertrude Jekyll, Wall and Water Gardens (London: Country Life, 1902).

24. Except for narcissus and gladiolus, winter-flowering bulbs have to be bought anew each time because Delhi is not cold enough for their resting period.

25. Michael Pollan, The Botany of Desire: A Plant's-Eye View of the World (New York: Random House, 2001), 59-110. Tulips are reported to have been first grown in Delhi by Firoz Shah Tughlaq in the fourteenth century.

26. Robert Irving, Indian Summer: Lutyens, Baker, and Imperial Delhi (Delhi: Oxford University Press, 1981), 226.

27. See Chapter 1, this volume.

28. Herbert, 268.

29. Quoted in Bowe, 76.

30. Irving, 226.

31. See Chapter 1, this volume.

32. Herbert, 198–202.

33. In fact, Lutyens insisted that the trees be kept cropped at a stipulated height, far less than the handsome crown of the full-grown maulsari.

34. Bowe, 76. However, Herbert cites other sources to say that the plantings were 'according to [Gertrude Jekyll's] precepts and colour harmonies' (Herbert, 264).

35. However, in 2013, the garden was planted in a coordinated scheme of yellow and white.

36. Herbert, 270. Constance Villiers-Stuart would have hated this; in Gardens of the Great Mughals, she complained about 'the influence of

our English landscape gardeners and their fixed belief in the universal virtue of mown grass' (Villiers-Stuart, x).

37. Jack Goody, The Culture of Flowers (Cambridge: Cambridge University Press, 1993).

CHAPTER THREE
Avenue and Forest Trees: Unravelling the Planting Scheme

1. See Chapter 2, this volume.

2. Walter George, "The Roadside Planting of Lutyens' New Delhi," Urban and Rural Planning Thought (April 1958): 84.

3. Eugenia W. Herbert, Flora's Empire: British Gardens in India (Philadelphia: University of Pennsylvania Press, 2011), 264.

4. George S.C. Swinton, John A. Brodie and Edwin L. Lutyens, Final Report of the Delhi Planning Committee on the Town Planning of the New Imperial Capital (Delhi: Superintendent, Government Printing, 1913): 16.

5. For a fuller treatment of the tree scheme, see Pradip Krishen, "Avenue Trees in Lutyens' Delhi: How They Were Chosen," in Celebrating Delhi, ed. Mala Dayal (New Delhi: Penguin Books India, 2012): 76–94.

6. George S.C. Swinton et al., 16.

7. By 'pseudo-avenues' I mean pathways that are noticeably broader than what might be considered necessary as mere walking paths, but not tarred or surfaced in a manner that would allow vehicular traffic.

8. Note by G.F. De Montmorency, Home Public, Delhi A, October 1912, nos. 1–2, Nehru Memorial Museum and Library. Griessen was brought to Delhi from Agra to take temporary charge of the planting and horticultural arrangements for the grand Durbar of 1911 and his services were later requisitioned for an 'imperial need' and he was placed in charge of tree planting and gardening in Delhi in 1912. Walter George also discusses the merits and character of Griessen and Locke as Delhi's horticulturists, in George, 81.

9. P.H. Clutterbuck, "Arrangements For Plantations of Young Avenue Trees for New Delhi," Proceedings of the Home Department, October 1912, Nehru Memorial Museum and Library.

10. W. R. Mustoe, Notes upon Roadside Arboriculture (Lahore: Government Printing, 1915).

11. Delhi was one of the southern districts of the Punjab right up until the new capital was announced in 1911.

12. Actually, karanj was planted in New Delhi on Lytton Road (now Copernicus Marg), but it failed and was soon after replaced with the maharukh tree (George, 87).

13. Like many other trees that were planted in New Delhi because they were thought to be evergreen, karanj is evergreen only when it is growing in moist conditions, such as along the banks of a perennial stream

14. Krishen, 2012.

15. The laurel fig is evergreen but has a distinct flush of new leaves late in March, even as it retains a fair bit of its old leaves.

16. The only road planted with maulsari in New Delhi is San Martin Marg which came into being long after Independence.

17. The Outer Ring Road had a short stretch of kosam trees near the IIT until the Metro was built, but of course this was outside Lutyens's Delhi and was probably planted up in the 1960s.

18. Among exotic trees which came to be used sporadically as arboricultural (roadside) trees in northern India before the twentieth century, one can also count two species of eucalyptus, the silky oak, jungle jalebi and the Spanish mahogany.

19. Mustoe enumerated shisham, eucalyptus (not clear which one), toot and babool as 'the best trees for roadside planting'. Not one of these species was used in the Viceregal Estate as an avenue tree. In a Supplementary Note, he lists 'other trees suitable for planting among civil stations or where variety is desired': Doon siris, phulai, bishopwood, semal, whistling pine, tun, khirk, banyan, goolar, laurel fig, kakkar, chinar, amda, imli, arjun and baheda (Mustoe, 14).

20. Captain Swinton et al., 4.

21. He meant P.H. Clutterbuck.

22. Viceroy Hardinge's letter to Lutyens, 19 August 1912, in the Hardinge Papers, Nehru Memorial Museum and Library.

23. R.N. Parker, "Afforestation of the Ridge at Delhi," Indian Forester January (1920): 25.

24. Parker, 25.

25. George, 87.

26. Vilaiti keekar was first brought to India in 1878.

27. George, 87.

28. The stated reason was that porcupines were damaging the roots and bases of trees planted on the Ridge.

29. Letter from the Military Secretary to the Viceroy, 18 January 1931, Delhi State Archives.

30. Letter from the Military Secretary to the Viceroy, 14 September 1934, Delhi State Archives.

31. Herbert, 83–96. Vicereine Canning, in particular, loved the untamed, wilder aspects of Barrackpore's grounds in the 1850s and the garden became known as 'Lady Canning's jungle'.

CHAPTER FOUR
Backstage: Gardeners at Work

1. Garden Chaudhari is the highest position among the malis (gardeners).

2. Started in 1948, the chrysanthemum show of the Young Women's Christian Association (YWCA) is a major event on Delhi's horticultural calendar, with a number of government departments as well as individuals vying for prizes for their blooms. The President's Estate also displays its choicest flowers there but, by convention, does not participate in the competition.

3. Interview with Jagdish, senior mali, on 29 September 2014.

4. Interview with Alakhnarayan Tiwari, senior mali, on 12 September 2014.

5. Rhesus Macaques are scared away by Gray Langur, so a captive langur is used to patrol an area from which the smaller monkeys are to be kept away.

6. Interview with Radheshyam, Senior Mali, on 12 September 2014.

7. Interview on 24 September 2014.

8. Interview on 17 September 2014.

9. Interview on 12 May 2015.

CHAPTER FIVE
Wildlife: All Creatures Great and Small

1. Harry G. Champion and S.K. Seth, A Revised Survey of the Forest Types of India (New Delhi: Government of India, 1968).

2. This has occurred due to suburban sprawl, exotic weed invasion, dumping of construction waste and encroachment by various institutions, both private and governmental. See Ravi Agarwal, "The Fight for an Urban Forest: The Delhi Ridge" in Nature Without Borders, ed. Mahesh Rangarajan, M.D. Madhusudan and Ghazala Shahabuddin (New Delhi: Orient Blackswan, 2014), 107–130.

3. Based on field surveys by Ghazala Shahabuddin and Pradip Krishen in the President's Estate; see Appendix A for scientific names of plant species mentioned in the text.

4. Pradip Krishen, Trees of Delhi: A Field Guide (Delhi: Dorling Kindersley, 2006).

5. See the section on 'Life in the forest understorey'.

6. Edward O. Wilson, The Diversity of Life (Massachusetts: Harvard University Press, 1992), 136–137.

7. Edward O. Wilson, "The Little Things that Run the World (The Importance and Conservation of Invertebrates)," Conservation Biology 1, no. 4 (1987): 344–346.

8. Millennium Ecosystem Assessment, Ecosystems and Human Well-being: A Synthesis (Washington DC: World Resources Institute, 2005).

9. See Appendix E for the list of insects recorded during the period August–December 2014.

10. Paul R. Ehrlich and Peter H. Raven, "Butterflies and Plants: A Study in Coevolution," Evolution 18, no. 4, (1964): 586–608.

11. Based on field surveys carried out by Ghazala Shahabuddin and Geetha Iyer from August–November 2014 and by G. Shahabuddin, Dhruv Pal and Anjali Verma from November 2014 to May 2015; see Appendix E for the scientific names of insect species mentioned in the text.

12. Daniel H. Janzen, "Ecological Characterization of a Costa Rican Dry Forest Caterpillar Fauna," Biotropica 20, no. 2, (1988): 120–135.

13. Based on surveys carried out by Anchal Sondhi and Sanjay Sondhi on the President's Estate in 2014.

14. Jesse R. Barber and Akito Y. Kawahara, "Hawkmoths Produce Anti-bat Ultrasound," Biology Letters 9 (2013): 20130161. http://www.dx.doi.org/10.1098/rsbl.2013.0161 (Accessed 17 May 2016).

15. K.A. Subramanian, Dragonflies of India: A Field Guide (New Delhi: Vigyan Prasar, 2009).

16. Ibid.

17. M. Schaefer, "Winter Ecology of Spiders (Araneida)," Zeitschrift für Angewandte Entomologie 83, no.1–4 (1977): 113–134.

18. Rainer Foelix, Biology of Spiders (New York: Oxford University Press, 2010).

19. Based on surveys undertaken by Manju Siliwal on the President's Estate in 2014; refer to Appendix F for scientific names of the spider species mentioned in the text.

20. Duane P. Harland and Robert R. Jackson, "Cues by which *Portia fimbriata*, an Araneophagic Jumping Spider, Distinguishes Jumping Spider Prey from Other Prey," Journal of Experimental Biology 203, no. 22 (2000): 3485–3494.

21. M. Théry and Jerome Casas, "Visual Systems: Predator and Prey Views of Spider Camouflage," Nature 415, no. 6868 (2002): 133.

22. Foelix, 2010.

23. Spinnerets are the organs in spiders which produce the fine silk used for making webs and wrapping prey.

24. Foelix, 2010.

25. See Appendix D for a list of reptiles and amphibians found on the Estate in surveys by Anjali Verma and Vishal Prasad.

26. J. C. Daniel, The Book of Indian Reptiles and Amphibians (Mumbai: Bombay Natural History Society and Oxford University Press, 2002).

27. See the section on 'Habitat fragmentation'.

28. See Chapter 3, this volume.

29. Vivek Menon, Indian Mammals: A Field Guide (Gurgaon: International Fund for Animal Welfare, Hatchette India and Wildlife Trust of India, 2014).

30. John Terborgh, "Maintenance of diversity in tropical forests," Biotropica 24, no. 2B (1992):283–292.

31. Stephen L. Buchmann and Gary P. Nabhan, The Forgotten Pollinators (Washington DC: Island Press, 1996).

32. Ibid.

33. John Terborgh, "Keystone Plant Resources in Tropical Forests," in Conservation Biology: Science of Scarcity and Diversity, ed. Michael E. Soule (California: Sinauer Associates, 1992), 330–344.

34. Defenders of Wildlife. "Southern Sea Otters: A Bumpy Road to Recovery." Defenders of Wildlife http://www.defendersblog.org/2013/09/southern-sea-otters-a-bumpy-road-to-recovery/ (accessed 24 January 2015)

CHAPTER SIX
Birds: Heirs of the Ecological Mosaic

1. G. Maheswaran, The Birds of Rashtrapati Bhavan (Mumbai: Bombay Natural History Society, 2007).

2. Thomas Mathew, Winged Wonders of Rashtrapati Bhavan (Delhi: Publications Division, Ministry of Information and Broadcasting, Government of India, 2014).

3. Refer to Appendix C for a list of bird species identified on the President's Estate.

4. Daniel G. Wenny and Douglas J. Levey, "Directed Seed Dispersal by Bellbirds in a Tropical Cloud Forest," Proceedings of the National Academy of Sciences 95 (1998): 6204–6207.

5. Ibid. Also see Pia Sethi and Henry Howe, "Recruitment of Hornbill-dispersed Trees in Hunted and Logged Forests of Indian Eastern Himalaya," Conservation Biology 23, no. 3 (2009): 710–718.

6. David Quammen, The Song of the Dodo: Island Biogeography in an Age of Extinction (New York: Scribner, 1996).

7. Salim Ali, The Book of Indian Birds (Mumbai: Bombay Natural History Society and Oxford University Press, 1996).

8. Richard Grimmett, Carol Inskipp and Tim Inskipp, Pocket Guide to the Birds of the Indian Subcontinent (New Delhi: Oxford University Press, 1999), 12.

9. Ibid.

10. Cagan H. Sekercioglu and others, "Disappearance of Insectivorous Birds from Tropical Forest Fragments," Proceedings of the National Academy of Sciences 99, no. 1 (2002): 263–267.

11. Ghazala Shahabuddin and Raman Kumar, "Effects of Extractive Disturbance on Bird Assemblages, Vegetation Structure and Floristics of Tropical Scrub Habitat, Sariska Tiger Reserve, India," Forest Ecology & Management 246 (2007): 175–185.

12. P.E. Donald, Rhys E. Green and M.F. Heath, "Agricultural Intensification and the Collapse of Europe's Farmland Bird Populations," Proceedings of Royal Society of London (b), 268 (2001): 25–29.

13. K.S. Gopi Sundar and Swati M. Kittur, "Methodological, Temporal and Spatial Factors Affecting Modelled Occupancy of Resident Birds in the Perennially Cultivated Landscape of Uttar Pradesh, India," Landscape Ecology 27, no.1 (2012): 59–71.

14. Hari Sridhar, Guy Beauchamp and Kartik Shanker, "Why Do Birds Participate in Mixed-Species Foraging Flocks? A Large-Scale Synthesis," Animal Behaviour 78, no. 2 (2009): 337–347.

15. Raman Kumar, Ghazala Shahabuddin and Ajith Kumar, "How Good are Managed Forests at Conserving Native Woodpecker Communities? A Study in Sub-Himalayan Dipterocarp Forests of Northwest India," Biological Conservation 144, no. 6 (2011): 1876–1884. The decline of the Great Slaty Woodpecker, the largest woodpecker in the world which lives in sub-Himalayan sal forests, is linked to the cutting of old trees for timber.

16. Rishad Naoroji, Birds of Prey of the Indian Subcontinent (New Delhi: Om Books International, 2006).

17. Rishad Naoroji, "Contamination in Egg Shells of Himalayan Greyheaded Fishing Eagle *Ichthyophaga nanaplumbea* in Corbett National Park, India," Journal of the Bombay Natural History Society 94, no. 2 (1997) 398–400.

18. Rhys E. Green and others, "Diclofenac Poisoning as a Cause of Vulture Population Declines across the Indian Subcontinent," Journal of Applied Ecology 41, no. 5 (2004): 793–800.

19. Mathew, 2014.

20. Amotz Zahavi and Avishag Zahavi, The Handicap Principle: A Missing Piece of Darwin's Puzzle (Oxford: Oxford University Press, 1997).

21. Ali, 1996.

CHAPTER SEVEN
Seasons: The Cycles of Life

1. Current Results, "Weather and Science Facts," Current Results, www.currentresults.com/Weather/India/average-yearly-precipitation.php (accessed 5 September 2015).

2. Pradip Krishen, Trees of Delhi: A Field Guide (Delhi: Dorling Kindersley, 2006), 17.

3. Krishen, 18. In his book, Jungle Trees of Central India: A Field Guide for Tree Spotters (Delhi: Penguin India, 2014), Krishen also notes that trees put out new leaves in the dry season so that they can produce the food needed for flowering, an energy-intensive activity requiring many nutrients (Krishen, JTCI, 34).

4. Though breeding is at a peak in the monsoon, peafowl tend to produce several clutches spaced through the year, except in winter.

5. Jackals are reported to breed throughout the year (Tej Kumar Shrestha, Mammals of Nepal: With Reference to those of India, Bangladesh, Bhutan and Pakistan; Hingham, UK: Steven Simpson Natural History Books, 1997). However, on the Estate, pups have been seen only in October, which points to mating in late summer and monsoon.

6. Florida Museum of Natural History. "Herpetology" University of Florida, http://www.flmnh.ufl.edu/herpetology/fl-snakes/list/indotyphlops-braminus (accessed 5 September 2015).

7. These bats are known to live mainly in caves and abandoned ruins and are likely to be commensal with human beings. See Vivek Menon, Indian Mammals: A Field Guide (Gurgaon: Hachette Book Publishing, 2014).

8. J. C. Daniel, The Book of Indian Reptiles and Amphibians (Mumbai: Bombay Natural History Society, 2002).

APPENDICES

APPENDIX A:
PLANTS OF THE PRESIDENT'S ESTATE
(and those mentioned in the text)



Kamini (*Murraya paniculata*)

TREES

Common name	Scientific name
Akash neem	*Millingtonia hortensis*
Amaltas	*Cassia fistula*
Amla	*Phyllanthus emblica*
Anaar	*Punica granatum*
Anjan	*Hardwickia binata*
Anjeeri	*Ficus palmata*
Arjun	*Terminalia arjuna*
Ashok	*Polyalthia longifolia*
Bael	*Aegle marmelos*
Baheda	*Terminalia bellirica*
Bakain	*Melia azaderach*
Banyan	*Ficus benghalensis*
Baobab	*Adansonia digitata*
Barna	*Crataeva adansonii* subsp. *odora*
Ber	*Ziziphus mauritiana*
Bilangada	*Flacourtia indica*
Bishopwood	*Bischofia javanica*
Bistendu	*Diospyros cordifolia*
Broadleaved bottle tree	*Brachychiton australis*
Buddha's coconut	*Pterygota alata*
Caribbean trumpet tree	*Tabebuia aurea*
Chamrod	*Ehretia laevis*
Chestnutleaf trumpet-bush	*Tecoma castanifolia*
Chikrassy	*Chukrasia tabularis*
Chinar	*Platanus orientalis*
Chir pine	*Pinus roxburghii*
Crape myrtle	*Lagerstroemia indica*
Dhak	*Butea monosperma*
Doodhi	*Wrightia tinctoria*

Doon siris	*Albizia procera*
Empress tree	*Pawlonia tomentosa*
Floss-silk tree	*Ceiba speciosa*
Gab	*Diospyros malabarica*
Gandhraj	*Gardenia jasminoides*
Goolar	*Ficus racemosa*
Gourd tree	*Crescentia alata*
Guava	*Psidium guajava*
Gulmohur	*Delonix regia*
Harshingar	*Nyctanthes arbor-tristis*
Hingot	*Balanites roxburghii*
Imli	*Tamarindus indica*
India rubber tree	*Ficus elastica*
Italian cypress	*Cupressus sempervirens*
Jacaranda	*Jacaranda mimosifolia*
Jadi	*Ficus amplissima*
Jamun	*Syzigium cumini*
Jarul	*Lagerstroemia speciosa*
Jhand	*Prosopis cineraria*
Jungle jalebi	*Pithecellobium dulce*
Kachnar	*Bauhinia variegata*
Kadi patta	*Bergera koenigii*
Kaim	*Mitragyna parviflora*
Kakkad	*Pistacia integgerima*
Kamini	*Murraya paniculata*
Kanak champa	*Pterospermum acerifolium*
Kanju	*Holoptelea integrifolia*
Karanj	*Pongamia pinnata*
Kareel	*Capparis decidua*
Kassod	*Senna siamea*
Katsagon	*Fernandoa adenophyllum*
Katthal	*Artocarpus heterophyllus*
Kauri Pine	*Agathis robusta*
Khair	*Acacia catechu*
Khirk	*Celtis tetrandra*
Khirni	*Manilkara hexandra*
Kosam	*Schleichera oleosa*
Krishna fig	*Ficus benghalensis* var. *krishnae*
Kumttha	*Acacia senegal*
Lasora	*Cordia dichotoma*
Laurel fig	*Ficus microcarpa*
Maharukh	*Ailanthus excelsa*
Mahua	*Madhuca longifolia* var. *latifolia*
Mango	*Mangifera indica*
Maulsari	*Mimusops elengi*
Morpankhi	*Platycladus orientalis*
Moulmein rosewood	*Milletia peguensis*
Neem	*Azadirachta indica*
New Caledonian pine	*Araucaria columnaris*
Nirgundi	*Vitex negundo*
Olive tree	*Olea europa*
Pania	*Ehretia acuminata*
Paradise tree	*Simarouba glauca*
Peelu	*Salvadora persica*
Peepal	*Ficus religiosa*
Phulai	*Acacia modesta*
Pilkhan	*Ficus virens*
Ponytail palm	*Beaucarnea recurvata*
Putranjiva	*Drypetes roxburghii*
Rai jamun	*Syzigium nervosum*
Red Frangipani	*Plumeria rubra*
Reettha	*Sapindus mukorossi*
Rhodesian wistaria	*Bolusanthus speciosus*
River red gum	*Eucalyptus camaldulensis*
Ronjh	*Acacia leucophloea*
Royal palm	*Roystonia regia*
Rudraksh	*Elaeocarpus ganitrus*
Sandalwood	*Santalum album*
Saptaparni	*Alstonia scholaris*
Sausage tree	*Kigelia africana*
Semal	*Bombax ceiba*
Shikakai	*Acacia concinna*
Shisham	*Dalbergia sissoo*
Sickle bush	*Dichrostachys cinerea*
Silky oak	*Grevillea robusta*
Siris	*Albizia lebbeck*
Sita-ashok	*Saraca asoka*
Son khair	*Senegalia ferruginea*
Sonjna	*Moringa oleifera*
South Indian mahua	*Madhuca longifolia* var. *longifolia*
Spanish mahogany	*Swietenia mahagoni*
Subabool	*Leucaena leucocephala*
Tambalacoque	*Sideroxylon grandiflorum*
Teak	*Tectona grandis*

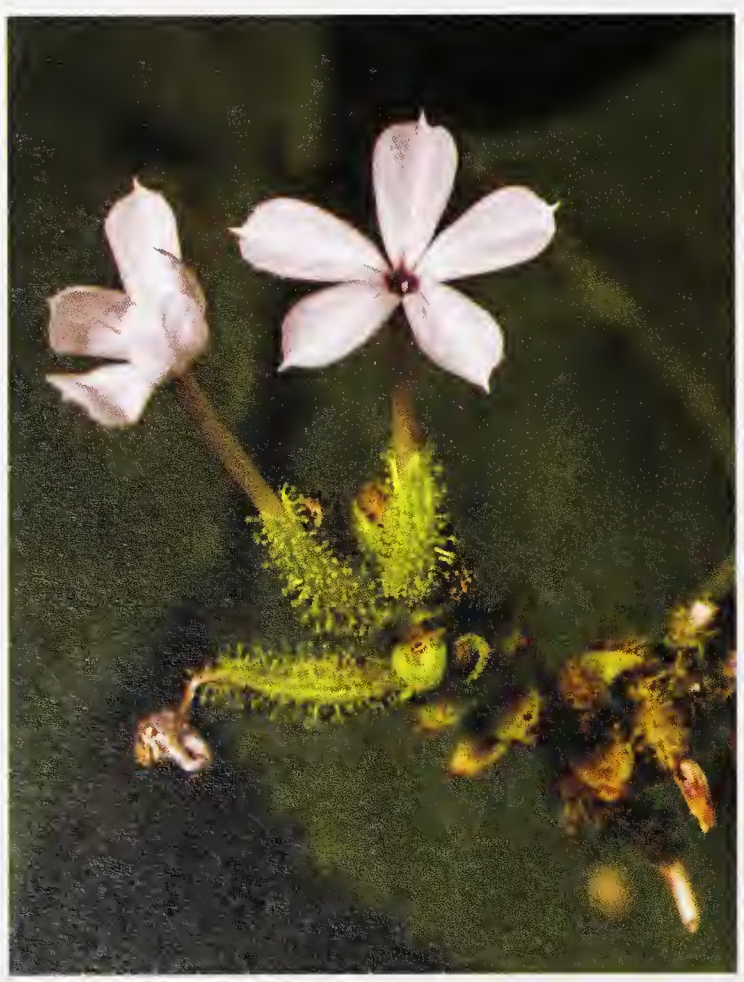


Pania (*Ehretia acuminata*)

Toot	*Morus alba*
Tun	*Toona ciliata*
Vilaiti keekar	*Prosopis juliflora*
Weeping bottlebrush	*Callistemon viminalis*
Weeping fig	*Ficus benjamina*
White frangipani	*Plumeria obtusa*
Wild almond	*Sterculia foetida*
Wild date palm	*Phoenix sylvestris*
Yellow oleander	*Thevetia peruviana*
—	*Ficus panda*

SHRUBS

Castor	*Ricinus communis*
Chandni	*Tabernaemontana divaricata*
Din-ka-raja	*Cestrum diurnum*
Firebush	*Hamelia patens*
Gondni	*Grewia tenax*
Heens	*Capparis sepiaria*
Hibiscus	*Hibiscus sinensis*
Karaunda	*Carissa congesta*
Lantana	*Lantana camara*
Mehndi	*Lawsonia alba*
Mogra	*Jasminum sambac*
Powder puff tree	*Calliandra* sp.



Chitrak (*Plumbago zeylanica*)

HERBS

Ashwagandha	*Withania somnifera*
Aak	*Calotropis procera*
Adulsa	*Justicia adhatoda*
Atrilal	*Peristrophe bicalyculata*
Chitrak	*Plumbago zeylanica*
Creeping woodsorrel	*Oxalis corniculata*
Desert rose	*Adenium* sp.
Doodhiya choti	*Blepharis maderaspatensis*
Gheekumari	*Aloe vera*
Goat weed	*Ageratum conizoides*
Jhinti	*Barleria prionitis*
Kalaghavani	*Dipteracanthus patulus/prostatus*
Kanghi 1	*Abutilon indicum*
Kanghi 2	*Abutilon ramosum*
Kharenti	*Malvastrum coromandelianum*
Mother-in-law's tongue	*Sansevieria* sp.
Prickly chaff flower	*Achyranthes aspera*
Sarpagandha	*Rauvolfia serpentina*
Vajradanti	*Barleria cristata*

CREEPERS

Akanadi	*Cissampelos pareira*
Arni	*Clerodendrum phlomidis*
Broom creeper	*Cocculus hirsutus*
Chirchinda	*Trichosanthes cucumerina*
Coral creeper	*Antigonon leptotus*
Dudhi ki bel	*Vallaris solanacea*
Flame vine	*Pyrostegia venusta*
Giloi	*Tinospora cordifolia*
Kundru	*Coccinia grandis*
Lassan bel	*Mansoa alliacea*
Madhavi lata	*Hiptage benghalensis*
Purple wreath	*Petrea volubilis*
Sagovani	*Pergularia daemia*
Shatavari	*Asparagus racemosus*
Star jasmine	*Trachelospermum jasminoides*
Trumpet vine (orange-flowered)	*Campsis radicans*
—	*Clerodendrum splendens*
—	*Maerua oblongifolia*
—	*Telosma pallida*

References:

Council for Scientific and Industrial Research. *The Useful Plants of India.* Delhi: Publications and Information Directorate, 1982.

Krishen, Pradip. *Trees of Delhi: A Field Guide.* Delhi: Dorling Kindersley, 2006.



Rhesus macaque (*Macaca mulatta*)

APPENDIX B
MAMMALS OF THE PRESIDENT'S ESTATE

Common name	Scientific name
Blyth's horseshoe bat	*Rhinolophus lepidus*
Five-striped palm squirrel	*Funambulus pennantii*
Golden jackal	*Canis aureus*
House shrew	*Suncus murinus*
Indian fruit bat	*Pteropus giganteus*
Rhesus macaque	*Macaca mulatta*
Small Indian mongoose	*Herpestes auropunctatus*

Reference:

Menon, Vivek. *Indian Mammals: A Field Guide*. Gurgaon: Hachette India, International Fund for Animal Welfare and Wildlife Trust of India, 2014.

APPENDIX C
BIRDS OF THE PRESIDENT'S ESTATE

Common name	Scientific name
Alexandrine parakeet	*Psittacula eupatria*
Ashy prinia	*Prinia socialis*
Asian brown flycatcher	*Muscicapa dauurica*
Asian koel	*Eudynamys scolopacea*
Asian paradise flycatcher	*Terpsiphone paradisi*
Asian pied starling	*Sturnus contra*
Bank myna	*Acridotheres ginginianus*
Barn owl	*Tyto alba*
Barn swallow	*Hirundo rustica*
Baya weaver	*Ploceus philippinus*
Bay-backed shrike	*Lanius vittatus*
Black drongo	*Dicrurus macrocercus*
Black ibis	*Pseudibis papillosa*
Black kite	*Milvus migrans*
Black redstart	*Phoenicurus ochruros*
Black-crowned night heron	*Nycticorax nycticorax*
Black-headed ibis	*Threskiornis melanocephalus*
Black-rumped flameback	*Dinopium benghalense*
Black-winged stilt	*Himantopus himantopus*
Bluethroat	*Luscinia svecica*
Blyth's reed warbler	*Acrocephalus dumetorum*
Booted warbler	*Hippolais caligata*
Brahminy starling	*Sturnus pagodarum*
Brown rock-chat	*Cercomela fusca*
Brown-headed barbet	*Megalaima zeylanica*
Cattle egret	*Bubulcus ibis*
Chestnut-shouldered petronia	*Petronia xanthocollis*
Citrine wagtail	*Motacilla citreola*
Collared scops owl	*Otus bakkamoena*
Common babbler	*Turdoides caudatus*
Common chiffchaff	*Phylloscopus collybita*
Common hawk cuckoo	*Hierococcyx varius*
Common hoopoe	*Upupa epops*
Common moorhen	*Gallinula chloropus*
Common myna	*Acridotheres tristis*
Common stonechat	*Saxicola torquatus*
Common tailorbird	*Orthotomus sutorius*
Common woodshrike	*Tephrodornis pondicerianus*
Coppersmith barbet	*Megalaima haemacephala*
Dusky crag martin	*Hirundo concolor*
Egyptian vulture	*Neophron percnopterus*
Eurasian collared dove	*Streptopelia decaocto*
Eurasian eagle owl	*Bubo bubo*
Eurasian golden oriole	*Oriolus oriolus*
Eurasian thick-knee	*Burhinus oedicnemus*
Great tit	*Parus major*
Greater coucal	*Centropus sinensis*



Rose-ringed parakeet (*Psittacula krameri*) [Photo credit: Ghazala Shahabuddin]

Green bee-eater	*Merops orientalis*
Green sandpiper	*Tringa ochropus*
Greenish warbler	*Phylloscopus trochiloides*
Grey francolin	*Francolinus pondicerianus*
Grey wagtail	*Motacilla cinerea*
Grey-breasted prinia	*Prinia hodgsonii*
Grey-headed canary flycatcher	*Culicicapa ceylonensis*
House crow	*Corvus splendens*
House sparrow	*Passer domesticus*
House swift	*Apus affinis*
Hume's warbler	*Phylloscopus humei*
Indian cormorant	*Phalacrocorax fuscicollis*
Indian grey hornbill	*Ocyceros birostris*
Indian peafowl	*Pavo cristatus*
Indian pond heron	*Ardeola grayii*
Indian robin	*Saxicoloides fulicata*
Indian roller	*Coracias benghalensis*
Indian silverbill	*Lonchura malabarica*
Intermediate egret	*Mesophoyx intermedia*
Jungle babbler	*Turdoides striata*
Large grey babbler	*Turdoides malcolmi*
Large-billed crow	*Corvus macrorhynchos*
Laughing dove	*Streptopelia senegalensis*
Lesser whitethroat	*Sylvia curruca*
Little cormorant	*Phalacrocorax niger*
Little grebe	*Tachybaptus ruficollis*
Long-billed pipit	*Anthus similis*
Long-tailed minivet	*Pericrocotus ethologus*
Long-tailed shrike	*Lanius schach*
Olive-backed pipit	*Anthus hodgsoni*
Oriental honey-buzzard	*Pernis ptilorhynchus*
Oriental magpie robin	*Copsychus saularis*
Oriental white-eye	*Zosterops palpebrosus*
Paddyfield pipit	*Anthus rufulus*
Pale-billed flowerpecker	*Dicaeum erythrorynchos*
Pied bushchat	*Saxicola caprata*
Pied cuckoo	*Clamator jacobinus*
Plain leaf warbler	*Phylloscopus neglectus*
Plum-headed parakeet	*Psittacula cyanocephala*
Purple sunbird	*Nectarinia asiatica*
Purple swamphen	*Porphyrio porphyrio*
Red avadavat	*Amandava amandava*
Red-throated flycatcher	*Ficedula parva*
Red-vented bulbul	*Pycnonotus cafer*
Red-wattled lapwing	*Vanellus indicus*
Red-whiskered bulbul	*Pycnonotus jocosus*
Rock pigeon	*Columba livia*
Rose-ringed parakeet	*Psittacula krameri*
Rosy starling	*Sternus roseus*
Rufous treepie	*Dendrocitta vagabunda*

Rufous-tailed shrike	*Lanius isabellinus*
Scaly-breasted munia	*Lonchura punctulata*
Shikra	*Accipiter badius*
Small minivet	*Pericrocotus cinnamomeus*
Spanish sparrow	*Passer hispaniolensis*
Spot-billed duck	*Anas poecilorhyncha*
Spotted dove	*Streptopelia chinensis*
Spotted owlet	*Athene brama*
Sulphur-bellied warbler	*Phylloscopus griseolus*
Tawny pipit	*Anthus campestris*
Tickell's blue flycatcher	*Cyornis tickelliae*
Ultramarine flycatcher	*Ficedula superciliaris*
Verditer flycatcher	*Eumyias thalassina*
White rumped munia	*Lonchura striata*
White wagtail	*Motacilla alba*
White-breasted waterhen	*Amaurornis phoenicurus*
White-browed wagtail	*Motacilla maderaspatensis*
White-eyed buzzard	*Butastur teesa*
White-rumped vulture	*Gyps bengalensis*
White-throated kingfisher	*Halcyon smyrnensis*
Wire-tailed swallow	*Hirundo smithii*
Yellow wagtail	*Motacilla flava*
Yellow-footed green pigeon	*Treron phoenicoptera*
Yellow-wattled lapwing	*Vanellus malabaricus*

Reference:

Grimmett, Richard, Carol Inskipp and Tim Inskipp. *Pocket Guide to the Birds of the Indian Subcontinent*. New Delhi: Oxford University, 1999.

APPENDIX D
REPTILES AND AMPHIBIANS OF THE PRESIDENT'S ESTATE

Common name	Scientific name
Brahminy worm snake	*Indotyphlops braminus*
Brook's gecko	*Hemidactylus brookii**
Buff striped keelback	*Amphiesma stolatum*
Common Indian toad	*Duttaphrynus melanostictus*
Common wolf snake	*Lycodon aulicus*
Indian burrowing frog	*Sphaerotheca breviceps*
Indian marbled toad	*Duttaphrynus stomaticus*
Oriental garden lizard	*Calotes versicolor*
Ornate narrow-mouthed frog	*Microhyla ornata*
Ratsnake	*Ptyas mucosa*
Spectacled cobra	*Naja naja*
Spotted supple skink	*Lygosoma punctata*
Yellow-bellied house gecko	*Hemidactylus flaviviridis*

* *tentative identification*

References:

Whitaker, Romulus and Ashok Captain. *Snakes of India: The Field Guide*. Chennai: Draco Books, 2004.

J.C. Daniel. *The Book of Indian Reptiles and Amphibians*. Mumbai: Bombay Natural History Society, 2002.

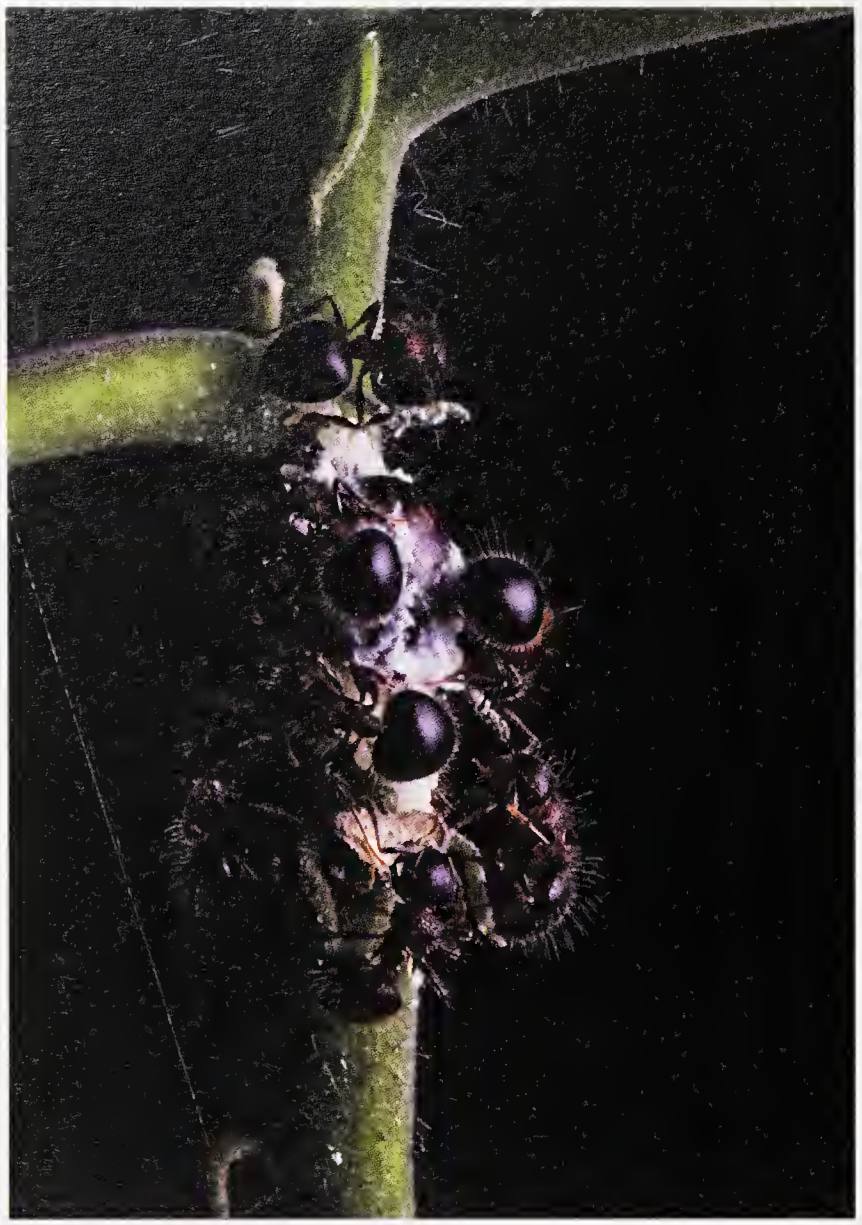
Gururaja, K.V. *Pictorial Guide to Frogs and Toads of the Western Ghats*. Bengaluru: Gubbi Labs, 2012.

Das, Indraneil. *A Photographic Guide to Snakes and Other Reptiles of India*. Sanibel Island, FL: Ralph Curtis Books, 2002.



Buff striped keelback (*Amphiesma stolatum*)

APPENDIX E
INSECTS OF THE PRESIDENT'S ESTATE



Tree ants (*Crematigaster* sp.)

Common name	Scientific name
Antlions (Neuroptera)	
Antlion	—
Ants, Bees and Wasps (Hymenoptera)	
Carpenter ant	*Camponotus* sp.
Tree ant	*Crematogaster* sp.
Dwarf honey bee	*Apis florea*
Carpenter bee	*Ceratina hieroglyphica*
Carpenter bee	*Xylocopa* sp.
Chalcid wasp	*Antrocephalus* sp.
Cuckoo wasp	—
Paper wasp	*Ropalidia* sp.
Paper wasp	*Polistes* sp.
Potter wasp	*Delta* sp.
Rock bee	*Apis dorsata*
Scoliid wasp	—
Bugs (Homoptera)	
Bark bug	—
Broad-headed bug	*Leptocorisa* sp.
Cowbug	—
Beetles (Coleoptera)	
Blister beetle	*Mylabris pustula*
Chafer beetle	*Gametes versicolor*
Darkling beetle	—
Dung beetle	—
Flea beetle	—
Ladybird beetle	*Sumnius vestita*
Ladybird beetle	*Aneglais cardonii*
Leaf beetle Sp. 1	—
Leaf beetle Sp. 2	—
Net-winged beetle	—
Dragonflies and Damselfies (Odonata)	
Black marsh trotter	*Tramea limbata*
Coromandel dart	*Ceriagrion* sp.
Crimson-tailed marsh hawk	*Orthetrum pruinosum*
Ditch jewel	*Brachythemis contaminata*
Green marsh hawk	*Orthetrum sabina sabina*
Rock glider	*Trithemis kirbyi*
Ruddy marsh skimmer	*Crocothemis servilia*
Flies (Diptera)	
Fleshfly	*Sarcophaga* sp.
Flowerfly or Hoverfly	—
Robberfly	—
—	*Eristalinus* sp.
Grasshoppers, Roaches and Crickets (Orthoptera)	
Garden litter cockroach	—
Long-horned grasshopper	—
Rice grasshopper	*Heiroglyphus* sp.
Praying mantis	—
Bush cricket	—
Butterflies and Moths (Lepidoptera)	
A. Butterflies	
Blue pansy	*Junonia orithya*



Plume moth

Blue tiger	*Tirumala limniace*
Common castor	*Ariadne merione*
Common crow	*Euploea core*
Common evening brown	*Mycalesis perseus*
Common grass yellow	*Eurema hecabe*
Common gull	*Cepora nerissa*
Common jay	*Graphium doson*
Common leopard	*Phalanta phalantha*
Common mormon	*Papilio polytes*
Common silverline	*Spindasis vulcanus*
Conjoined swift	*Pelopidas conjuncta*
Indian fritillary	*Argynnis hyperbius*
Large cabbage white	*Pieris brassicae*
Large salmon arab	*Colotis fausta*
Large threering	*Ypthima asterope*
Lemon emigrant	*Catopsilia pomona*
Lemon pansy	*Junonia lemonias*
Lime butterfly	*Papilio demoleus*
Mottled emigrant	*Catopsilia pyranthe*
One-spot grass yellow	*Eurema andersoni*
Painted lady	*Vanessa cardui*
Pale grass blue	*Pseudozizeeria maha*
Peacock pansy	*Junonia almana*
Pioneer	*Belenois aurota*
Plain tiger	*Danaus chrysippus*
Plains cupid	*Chilades pandava*
Small orange-tip	*Colotis etrida*
Striped albatross	*Appias libythea*
Striped pierrot	*Tarucus nara*
Striped tiger	*Danaus genutia*
Tiny grass blue	*Zizula hylax*
White orange-tip	*Ixias marianne*
Yellow orange-tip	*Ixias pyrene*
Yellow pansy	*Junonia hierta*

B. Moths

Bean pod borer	*Maruca vitrata*
Beet webworm moth	*Spoladea recurvalis*
Cucumber moth	*Diaphania indica*
Fruit piercer	*Oraesia emarginata*
Grass moth	*Sameodes cancellalis*
Grass moth	*Gadessa nilusalis*
Grass moth	*Botyodes diniasalis*
Owlet moth	*Spirama cf. helicina*
Plume moth	—
Rice leaf-roller	*Cnaphalocrocis medinalis*
Snout moth	*Hypena* sp.
Tiger moth	*Creatonotos gangis*
Tussock moth	—
White-pupilled scallop moth	—
—	*Chiasmia* sp.
—	*Erythroplusia pyropia*
—	*Eublemma anachoresis*
—	*Pelagodes near veraria*
—	*Scopula* sp.
—	*Thalassodes quadraria*
—	*Traminda mundissima*

Note:

The abbreviation 'sp.' is used when only the genus to which the species belongs can be identified.

Several insect species that were identified have not been assigned common names. They are listed only by their scientific names.

References:

Kehimkar, Isaac. *The Book of Indian Butterflies*. Mumbai: Bombay Natural History Society and Oxford University Press, 2008.

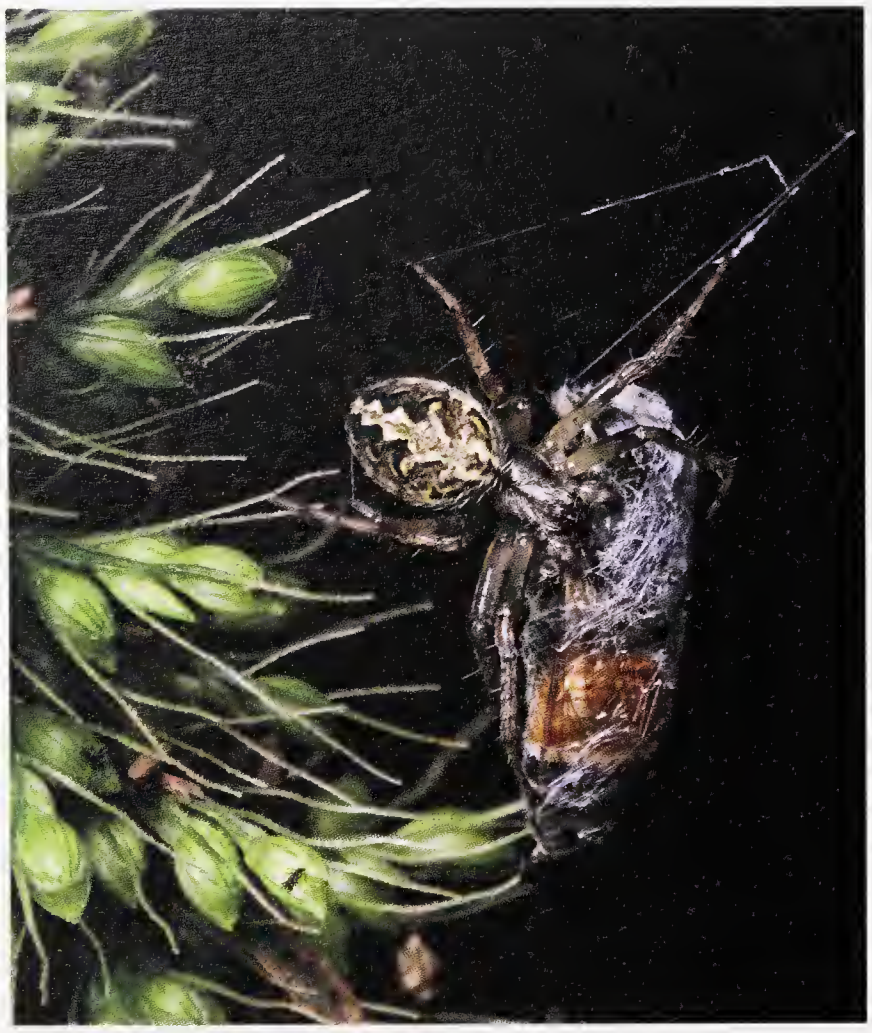
Kunte, K., P. Roy, S. Kalesh and U. Kodandaramaiah (eds.) *Butterflies of India*, v. 2.10. Bengaluru: Indian Foundation for Butterflies, 2015.

Haruta, Toshiro, ed. *Moths of Nepal*, Parts 1-6. Japan Heterocists' Society, 1992–2000.

Hampson, G. *The Fauna of British India including Ceylon and Burma, Moths*. Vols 1-4. London: Taylor & Francis, 1892-96.

Holloway, J.D. "Moths of Borneo, Parts 1-18", http:// www.mothsofborneo.com.

APPENDIX F
SPIDERS OF THE PRESIDENT'S ESTATE



Orb-web spider (*Neoscona theisi*)

Common name	Scientific name
Adanson's house jumper	*Hasarius adansoni*
Ant-mimicking spider	*Myrmaraclne tristis*
Cellar spider	*Pholcus fragillimus*
Comb-footed spider	*Faiditus* sp.
Comb-footed spider	*Steatoda* sp.
Comb-footed spider	*Theridion* sp.
Common garden spider	*Neoscona mukerjei*
Crab spider	*Tmarus* sp.
Decorative silver orb spider	*Leucauge decorata*
Flower crab spider	*Thomisus* sp.
Funnel-web spider	*Hippasa* sp.
Garden spider	*Argiope anasuja*
Grey wall jumper	*Menemerus bivittatus*
Hasselt's spiny spider	*Gasteracantha hasselti*
Jumping spider	*Carrhotus* sp.
Jumping spider	*Hyllus semicupreus*
Jumping spider	*Hyllus* sp.
Jumping spider	*Phintella vittata*
Jumping spider	*Plexippus paykulli*
Jumping spider	*Rhene flavigera*
Jumping spider	*Thyene imperialis*
Lynx spider	*Oxyopes bharatae*
Lynx spider	*Oxyopes chittrae*
Lynx spider	*Oxyopes pankaji*
Lynx spider	*Oxyopes* sp.
Mesh-weaver spider	*Dictyna* sp.
Mexican hat spider	*Philoponella* sp.
Nursery web spider	*Euprosthenops* sp.
Orb-web spider	*Chorizopes* cf. Khanjanes
Orb-web spider	*Chorizopes* sp. nov.
Orb-web spider	*Cyclosa* sp.
Orb-web spider	*Erovixia excelsus*
Orb-web spider	*Neoscona sinhagadensis*
Orb-web spider	*Neoscona* sp.
Orb-web spider	*Neoscona vigilans*
Orb-web spider	*Neoscona theisi*
Orb-web spider	*Singa* sp.
Orb-web weaver	*Cyrtarachne* cf. promilai
Sac spider	*Clubiona filicata*
Signature spider	*Argiope aemula*
Social spider	*Stegodyphus pacificus*
Tailed cellar spider	*Crossopriza lyoni*
Thin-legged wolf spider	*Pardosa birmanica*
Thin-legged wolf spider	*Pardosa* sp.
Tropical tent-web spider	*Cyrtophora citricola*
Two-striped jumper	*Telmonia dimidiata*
Two-tailed spider	*Hersilia savignyi*
Wall spider	*Oecobius putus*
Yellow sac spider	*Cheiracanthium* sp.

Note:
The abbreviation 'sp.' is used when only the genus to which the species belongs can be identified.
Several species that were identified have not been assigned common names. They are listed only by their scientific names.

References:

Tikader, B.K. and M.S. Malhotra. *Fauna India (Araneae)* vol. 1. Delhi: Manager of Publications, Government of India, 1980.

Tikader, B.K. *Fauna India (Araneae)* vols. 2–3. Delhi: Manager of Publications, Government of India, 1982.

Koh, J.K. and Leong, T.M. *Biodiversity in the Heart of Borneo: Spiders of Brunei Darussalam*. Borneo: Natural History Publications, 2013.

ACKNOWLEDGEMENTS

When research involves strolling through gardens, groves and vegetable beds, looking at trees, watching birds and chasing butterflies, chatting with malis and residents of the President's Estate, work becomes a picnic. It is a pleasure to acknowledge our gratitude to everyone who made this project possible.

Our access to the Rashtrapati Bhavan grounds during the 14 months of research was facilitated by U.D. Kukreti, Officer on Special Duty (Horticulture). P.N. Joshi, Section Officer (Horticulture), provided detailed information about the formal gardens. The malis were kind enough to talk to us in their spare time, indulging our ignorance, entertaining us with anecdotes, tea and samosas.

The IGNCA and the Steering Committee supervised this project. The Sahapedia team led by Sudha Gopalakrishnan provided excellent support to keep us on track and patience when we strayed off the rails. Yashaswini Chandra fixed the rattling nuts and bolts of a project that, towards the end, seemed to be a hurtling engine of deadlines. Nirmal Kanti Bhattacharjee helped to fine-tune the text and Aruna Ghose and Razia Grover polished it into streamlined gleam. Brinda Datta brilliantly pulled together words and images; this book owes a lot to her eye and imagination.

Ektaa Jain, Dhruv Pal, Akanksha Thapa and Anjali Verma assisted with the research and Sanjay Rawat with the photography. They have been of great help in the field and the archives.

The Estate's spiders were surveyed by Manju Siliwal, moths by Anchal Khemka, and reptiles and amphibians by Vishal Prasad. Geetha Iyer, Surya Prakash and Sanjay Sondhi assisted with the identification of insects.

Ghazala Shahabuddin was the scientific backbone of this project. Her expertise as a field biologist led to the yearlong wildlife surveys that have produced new information about the President's Estate and added to our appreciation of its ecology. Thanks to her, this book can claim to be an authoritative document of the Estate's flora and fauna.

Narendra Bisht photographed everything, from ants to zinnias, with unflagging enthusiasm and attention. He, quite literally, went to great lengths to get his pictures, even hiring the tallest crane from the Delhi Fire Brigade to get a panorama of the President's Estate. His work shines a light on the beauty before our eyes.

Patrick Bowe, Narayani Gupta, Shruthi Herbert, Martin Lutyens, Rajneesh (Private Secretary to the President), H.Y. Mohan Ram, Rahul N. Ram, Margaret Richardson, Meeta Sandeep, and Vicky Wilson at the Royal Institute of British Architects, provided advice and help of various kinds.

Pradip Krishen has been a stellar guide and stalwart friend to this project. His generosity in matters botanical, photographic and literary has enriched this book beyond measure.

Thank you all.



BIBLIOGRAPHY

Agarwal, Ravi. "The Fight for an Urban Forest: The Delhi Ridge." In *Nature Without Borders*, edited by Mahesh Rangarajan, M.D. Madhusudan and Ghazala Shahabuddin. 107–130. New Delhi: Orient Blackswan, 2014.

Ali, Salim. *The Book of Indian Birds*, 12th edition. Mumbai: Bombay Natural History Society and Oxford University Press, 1996.

Barber, J.R. and A.Y. Kawahara. "Hawkmoths Produce Anti-bat Ultrasound." *Biology Letters* 9 (2013): 20130161. http://www.dx.doi.org/10.1098/rsbl.2013.0161 (Accessed 17 May 2016).

Bowe, Patrick ."'The Genius of an Artist': William R. Mustoe and the Planting of the City of New Delhi and its Gardens," *Garden History* 37, no. 1 Summer (2009): 68–79.

Buchmann, Stephen L. and Gary P. Nabhan. *The Forgotten Pollinators.* Washington DC: Island Press, 1996.

Champion, H.G. and S.K. Seth. *A Revised Survey of the Forest Types of India.* New Delhi: Government of India, 1968.

Cornell Lab of Ornithology, "All about Birds," Cornell University, http://www.birds.cornell.edu/AllAboutBirds/studying/migration (Accessed 20 December 2015).

Council for Scientific and Industrial Research. *The Useful Plants of India.* Delhi: Publications and Information Directorate, 1982.

Current Results, "Weather and Science Facts", Current Results, http: //www.currentresults.com/Weather/India/average-yearly-precipitation.php (Accessed on 5 September 2015).

Cuthell, Edith. *My Garden in the City of Gardens*. London: John Lane, 1905.

Daniel, J.C. *The Book of Indian Reptiles and Amphibians*. Mumbai: Bombay Natural History Society and Oxford University Press, 2002.

Das, Indraneil. *A Photographic Guide to Snakes and Other Reptiles of India.* Sanibel Island, FL: Ralph Curtis Books, 2002.

Defenders of Wildlife. "Southern Sea Otters: A Bumpy Road to Recovery." Defenders of Wildlife http://www.defendersblog.org/2013/09/southern-sea-otters-a-bumpy-road-to-recovery (Accessed 24 January 2015).

Donald, P.E., Rhys E. Green and M.F. Heath. "Agricultural Intensification and the Collapse of Europe's Farmland Bird Populations." *Proceedings of Royal Society of London* (b), 268 (2001): 25–29.

Drayton, Richard. *Nature's Government: Science, Imperial Britain, and the "Improvement" of the World.* New Haven, CT: Yale University Press, 2000.

Ehrlich, Paul R. and Peter H. Raven. "Butterflies and Plants: A Study in Coevolution." *Evolution* 18, no. 4 (1964): 586–608.

Foelix, Rainer, *Biology of Spiders*, 3rd edition. New York: Oxford University Press, 2010.

George, Walter. "The Roadside Planting of Lutyens' Delhi," *Urban and Rural Planning Thought* April (1958): 78–94.

Goody, Jack. *The Culture of Flowers.* Cambridge: Cambridge University Press, 1993.

Gopi Sundar, K.S. and Swati M. Kittur. "Methodological, Temporal and Spatial Factors Affecting Modelled Occupancy of Resident Birds in the Perennially Cultivated Landscape of Uttar Pradesh, India." *Landscape Ecology* 27, no.1 (2012): 59–71.

Grimmett, Richard, Carol Inskipp and Tim Inskipp. *Pocket Guide to the Birds of the Indian Subcontinent.* New Delhi: Oxford University Press, 1999.

Gururaja, K.V. *Pictorial Guide to Frogs and Toads of the Western Ghats.* Bengaluru: Gubbi Labs, 2012.

Hampson, G. *The Fauna of British India including Ceylon and Burma, Moths.* Volumes 1–4. London: Taylor & Francis, 1892–96.

Hardinge, Charles. *My Indian Years, 1910–1916: The Reminiscences of Lord Hardinge of Penshurst.* London: John Murray, 1948.

Harland, Duane P. and Robert R. Jackson, "Cues by which *Portia fimbriata*, an Araneophagic Jumping Spider, Distinguishes Jumping Spider Prey from Other Prey." *Journal of Experimental Biology* 203, no. 22 (2000): 3485–94.

Haruta, Toshiro, ed. *Moths of Nepal*, Parts 1–6. Japan Heterocists' Society, 1992–2000.

Herbert, Eugenia W. *Flora's Empire: British Gardens in India.* Philadelphia: University of Pennsylvania Press, 2011.

Hobhouse, Penelope. *Gardens of Persia.* London: Cassell Illustrated, 2004.

Holloway, J.D. "Moths of Borneo, Parts 1–18," http:// www.mothsofborneo.com.

Howard, Ebenezer. *Garden Cities of Tomorrow.* London: Faber and Faber, 1902 [1946].

Hussey, Christopher. *The Life of Sir Edwin Lutyens.* London: Country Life, 1950.

Irving, Robert. *Indian Summer: Lutyens, Baker, and Imperial Delhi.* Delhi: Oxford University Press, 1981.

Janzen, Daniel H. "Ecological Characterization of a Costa Rican Dry Forest Caterpillar Fauna." *Biotropica* 20, no. 2 (1988): 120–135.

Jekyll, Gertrude. *Wall and Water Gardens.* London: Country Life, 1902.

Kehimkar, Isaac. *The Book of Indian Butterflies.* Mumbai: Bombay Natural History Society and Oxford University Press, 2008.

Koh, J.K. and Leong, T.M. *Biodiversity in the Heart of Borneo: Spiders of Brunei Darussalam.* Borneo: Natural History Publications, 2013.

Krishen, Pradip. *Trees of Delhi: A Field Guide.* Delhi: Dorling Kindersley, 2006.

Krishen, Pradip. "Avenue Trees in Lutyens' Delhi: How They Were

Chosen." In *Celebrating Delhi*, ed. Mala Dayal, 76–94. New Delhi: Penguin Books India, 2012.

Krishen, Pradip. *Jungle Trees of Central India: A Field Guide for Tree Spotters*. New Delhi: Penguin India, 2014.

Kumar, Raman, Ghazala Shahabuddin and Ajith Kumar. "How Good are Managed Forests at Conserving Native Woodpecker Communities? A Study in Sub-Himalayan Dipterocarp Forests of Northwest India." *Biological Conservation* 144, no. 6 (2011): 1876–84.

Kunte, K., P. Roy, S. Kalesh and U. Kodandaramaiah (eds.) *Butterflies of India*, vol. 2.10. Bengaluru: Indian Foundation for Butterflies, 2015.

Lahiri, Nayanjot. "Delhi's Capital Century (1911-2011): Understanding the Transformation of the City," Paper presented at the Agrarian Studies Colloquium, Yale University, 4 March 2011, http://agrarianstudies.macmillan.yale.edu/sites/default/files/files/colloqpapers/20lahiri.pdf.

Maheswaran, G. *The Birds of Rashtrapati Bhavan*. Mumbai: Bombay Natural History Society, 2007.

Mathew, Thomas. *Winged Wonders of Rashtrapati Bhavan*. Delhi: Publications Division, Ministry of Information and Broadcasting, Government of India, 2014.

Menon, Vivek. *Indian Mammals: A Field Guide*. Gurgaon: Hachette India, International Fund for Animal Welfare and Wildlife Trust of India, 2014.

Millennium Ecosystem Assessment. *Ecosystems and Human Well-being: A Synthesis*. Washington DC: World Resources Institute, 2005.

Mustoe, W.R. *Notes upon Roadside Arboriculture*. Lahore: Government Printing, 1915.

Naoroji, Rishad. *Birds of Prey of the Indian Subcontinent*. New Delhi: Om Books International, 2006.

Naoroji, Rishad. "Contamination in Egg Shells of Himalayan Greyheaded Fishing Eagle Ichthyophaga nanaplumbea in Corbett National Park, India." *Journal of the Bombay Natural History Society* 94, no.2 (1997): 398–400.

Parker, R.N. "Afforestation of the Ridge at Delhi." *Indian Forester* January (1920): 21-28.

Pollan, Michael. *The Botany of Desire: A Plant's-Eye View of the World*. New York: Random House, 2001.

Quammen, David. *The Song of the Dodo: Island Biogeography in an Age of Extinction*. New York: Scribner, 1996.

Risaluddin, Saba. *The Quest for Paradise: Gardens, Past, Present and Future*. New Delhi: Niyogi Books, 2013.

Robbins, Paul. *Lawn People: How Grasses, Weeds, and Chemicals Make Us Who We Are*. Philadelphia: Temple University Press, 2007.

Sekercioglu, Cagan H. and others. "Disappearance of Insectivorous Birds from Tropical Forest Fragments." *Proceedings of the National Academy of Sciences* 99, no. 1 (2002): 263–267.

Sethi, Pia and Henry Howe. "Recruitment of Hornbill-dispersed Trees in Hunted and Logged Forests of Indian Eastern Himalaya." *Conservation Biology* 23, no. 3 (2009): 710–718.

Shahabuddin, Ghazala and Raman Kumar. "Effects of Extractive Disturbance on Bird Assemblages, Vegetation Structure and Floristics of Tropical Scrub Habitat, Sariska Tiger Reserve, India." *Forest Ecology & Management* 246 (2007): 175–85.

Sharada Prasad, H.Y. *Rashtrapati Bhavan: The Story of the President's House*. New Delhi: The Publications Division, Ministry of Information and Broadcasting, Government of India, 1992.

Shrestha, Tej Kumar. *Mammals of Nepal: With Reference to those of India, Bangladesh, Bhutan and Pakistan*. Hingham, UK: Steven Simpson Natural History Books, 1997.

Sridhar, Hari, Guy Beauchamp and Kartik Shanker. "Why Do Birds Participate in Mixed-Species Foraging Flocks? A Large-Scale Synthesis." *Animal Behaviour* 78, no. 2 (2009): 337–347.

Stanley, Lady Beatrix. "Gardening in India." *The Gardeners' Chronicle*, 23 May 1931.

Subramanian, K.A. *Dragonflies of India: A Field Guide*. New Delhi: Vigyan Prasar, 2009.

Swinton, George S.C., John A. Brodie and Edwin L. Lutyens. *Final Report of the Delhi Planning Committee on the Town Planning of the New Imperial Capital*. Delhi: Superintendent, Government Printing, 1913.

Temple-Wright, Mrs. R. *Flowers and Gardens in India: A Manual for Beginners*, 4th ed. Calcutta: Thacker, Spink, 1898.

Terborgh, John. "Keystone Plant Resources in Tropical Forests." In *Conservation Biology: Science of Scarcity and Diversity*, edited by Michael E. Soule, 330–44. California: Sinauer Associates, 1986.

Terborgh, John. "Maintenance of Diversity in Tropical Forests." *Biotropica* 24, no. 2B, (1992): 283–92.

Théry, M. and Jerome Casas. "Visual Systems: Predator and Prey Views of Spider Camouflage." *Nature* 415, no. 6868 (2002): 133.

Tikader, B.K. and M.S. Malhotra. *Fauna India (Araneae)*, vol. 1. Delhi: Manager of Publications, Government of India, 1980.

Tikader, B. K. and M.S. Malhotra. *Fauna India (Araneae)*, vols. 2–3. Delhi: Manager of Publications, Government of India, 1982.

Wenny, Daniel G. and Douglas J. Levey. "Directed Seed Dispersal by Bellbirds in a Tropical Cloud Forest." *Proceedings of the National Academy of Sciences* 95 (1998): 6204–207.

Whitaker, Romulus and Ashok Captain. *Snakes of India: The Field Guide*. Chennai: Draco Books, 2004.

Wilson, Edward, O. "The Little Things that Run the World (The Importance and Conservation of Invertebrates)." *Conservation Biology* 1, no. 4 (1987): 344–46.

Wilson, Edward O. *The Diversity of Life*. Massachusetts: Harvard University Press, 1992.

Zahavi, Amotz and Avishag Zahavi. *The Handicap Principle: A Missing Piece of Darwin's Puzzle*. Oxford: Oxford University Press, 1997.

INDEX

A

adulsa, 130
Akbar, Emperor, 34
Annual Report for Government Gardens 1935–6, 14–15

B

Babur, Emperor, 32, 34
Baker, Herbert, 17
banyan, 35, 84–85, 138, 157
bats, 140, 142, 156, 157, 214, 216, 231, 232, 233
bees,
    Carpenter, 145, 204, 206
    Dwarf Honey, 145, 204, 212
    Rock, 145, 232
beetles, 132
    Blister, 127, 206
    Chafer, 204, 212, 215
    Dung, 204
    Flea, 130
    Ladybird, 212
    Leaf, 130–131, 200, 204
    Net-winged, 204–205, 212
ber, 129, 212, 214, 216, 220
birds, 132
  Barbet,
      Brown-headed, 138, 172, 191, 195, 202, 206
      Coppersmith, 161, 172, 214
  Babbler,
      Common, 186
      Jungle, 184, 220
  Bulbul,
      Red-vented, 162–163, 191, 202, 206, 214
      Red-whiskered, 162–163, 191, 202, 214, 231
  Cuckoo, Pied, 202
  Drongo, Black,194, 206
  Duck, Spot-billed, 180, 208
  Egret, Cattle, 172, 183, 206
  Flameback, Black-rumped, 163, 184, 195, 208
  Flycatcher,
      Asian Paradise, 184, 186–187, 193
      Grey-headed Canary, 180, 186, 216
      Red-throated, 180, 220
      Tickell's Blue, 193–194
      Ultramarine, 193, 228
      Verditer, 172, 178, 193, 228
  Francolin, Grey,130, 156, 184, 220
  Heron, Indian Pond, 180, 208
  Honey-buzzard, Oriental, 164, 184–185, 192, 208
  Hornbill, Indian Grey, 138, 167, 169, 172, 191, 195, 206, 208, 214, 220
  Kite, Black, 169, 188–189
  Koel, Asian, 172, 191, 202, 204, 231
  Lapwing, Red-wattled, 172, 174
  Moorhen, Common, 180, 208, 214
  Munia, scaly-breasted, 172, 176
  Myna, Common, 169–170, 195, 206
  Owl, 192
      Barn, 170–171, 192
      Collared Scops, 192
      Spotted Owlet, 142, 164, 188, 195, 216
  Parakeet,
      Alexandrine, 138, 163, 165, 169–170, 172, 191, 195, 220
      Plum-headed, 163, 166, 172, 191
      Rose-ringed, 163, 166, 172, 188, 191, 195, 206, 214, 220, 222
  Peafowl, Indian, 156, 163, 196–197, 202
  Pigeon,
    Rock, 170, 188
    Yellow-footed Green, 164, 172, 191, 206, 208, 222
  Prinia,
    Ashy, 163, 202, 204
    Grey-breasted, 184
    Robin, Oriental Magpie, 194, 220
    Sandpiper, Green, 180, 182, 214
    Shikra, 188, 192, 208, 214
    Sunbird, Purple, 163, 202, 220
    Starling,
        Asian Pied, 169
        Brahminy, 169
        Rosy, 170, 228
    Treepie, Rufous,163, 184, 220, 222
    Vulture, Egyptian, 163, 168, 169, 192, 231
    Wagtail,
        Grey, 169, 182, 193
        White, 163–164, 169
    Warbler,
        Greenish, 184, 194
        Hume's 184, 193–194, 220
        Sulphur-bellied, 184, 194, 220
    Waterhen,White-breasted, 180, 214
    White-eye, Oriental, 191, 194
    Whitethroat, Lesser, 184, 193–194, 220
bistendu, 98
butterflies, 132, 134–135, 143, 216
        Blue Tiger, 204–205, 232
        Common Crow, 200, 208
        Common Mormon, 134, 200, 208
        Common Silverline, 138, 204

Lemon Pansy, 200, 214
Lime, 134, 200, 228–229
Orange-tip,
Small, 208
White, 208, 214
Yellow, 208, 214
Pieridae, 134, 208
Pioneer, 134, 208
Plain Tiger, 200, 208, 218-9
butterflies, mud-puddling, 201
Butterfly Garden, *see* Circular Garden

C

Cantonment Road (Willingdon Crescent/Mother Teresa Crescent), 93, 126, 158
Central Public Works Department, 89, 98, 120
Central Ridge, 90–92, 94, 126, 156, 158
Centre for Science and Environment, 26
chamrod, 97, 128
charbagh (walled garden), 32–37
four quadrants, significance of, 32
chitrak, 130–131, 228
Circular Garden, 43, 57–59, 61
Clutterbuck, P.H., 14, 71, 72
Curzon, Lord, 60–61

D

Dalikhana, 111, 117–119, 126, 129, 134, 140, 147, 153, 160, 172, 180, 214
Dalikhana pond, 186, 211, 214, 232
damselfly, 146, 232
Coromandel Dart, 147, 214
Delhi Town Planning Committee, 12, 17, 69, 90
Doon siris, 107, 169, 212
dragonflies, 132, 146–147, 232
Black Marsh Trotter, 147
Green Marsh Hawk, 200
Rock Glider, 146, 200
dudhi ki bel, 226, 228

E

Ehrlich, Paul, 132

F

Fatehpur Sikri, 34
flowers, cultivated, 36, 44-59, 61, 112
Forecourt, 20, 79, 129, 170
fountains, 30, 39–41, 44, 56, 91, 122, 160, 163

G

gardens and gardening,
English gardens and parks, 20, 37, 39, 94
English gardening in India, 35–37
Islamic gardening, *see* charbagh
President's Estate, gardening on, 20, 27–28, 65, 109–125
care of roses, 112–113
Circular Garden, 43, 57–59, 61
Dalikhana, 117–119
Long Garden, 39, 42, 43, 49-55
maintenance, 110, 116
formal gardens, 110–115, 123–125
Mughal Garden, 18, 30, 37, 39, 41–47, 61, 76, 112, 122, 147, 163, 197, 216, 222
water garden, 39
George, Walter, 15, 93
golf course, 98,129, 169, 212, 222, 231
goolar, 126, 138, 157, 214, 216
gourd tree, 102–103

H

habitat fragmentation, 158–159
Hailey, Malcolm, 12
Handicap Principle, 197
Hardinge, Lady, 39
Hardinge, Lord, 12, 14, 91–92
Herbal Gardens, 26, 28, 122, 220, 231
Hestercombe House, 39
Humayun's Tomb, 34, 60
Hussain, Zakir, 26, 122

I

Imperial Capital Committee, 91
insects, 132–133. *see also* bees; butterflies; dragonflies; moths
invasive species
lantana, 126, 135, 191, 218
subabool, 126, 159, 196
vilaiti keekar *(Prosopis juliflora),* 14, 15, 93-94, 95, 126, 129, 159, 218, 220, 222, 228
Irwin, Lord, 17

J

Jekyll, Gertrude, 17, 20, 39, 60–61
jhinti, 130

K

kalaghavani, 130–131, 208
Kalam, Abdul, 24, 26, 95, 122
kanghi, 228
karanj, 72–73, 164, 188, 193,198, 208, 228
keystone species, 138
khirni, 69, 71, 77, 98, 196, 198, 228
kosam, 86–87, 126
kumttha, 96

L

lantana, 126, 135, 191, 218
lassan bel, 55
laurel fig, 19, 69, 79–80, 138, 196
lawns, 30, 35–36, 41, 56, 62, 69, 76, 98, 110, 112, 117, 131, 135, 160, 163–164, 169, 200, 204, 231
layout of Viceroy's House and gardens, 21
lemon-scented gum, 104
lizards, 132, 143,153–154, 204
Long Garden, 39, 42, 43, 49-55
Lutyens, Edwin, 12, 17–18, 20, 28, 30, 38–39, 60–61, 68, 90–91, 94
original plan for the formal gardens, 42

M

Maerua oblongifolia, 228
mahtab bagh (moonlight garden), 34
mammals, 156–157
Black-naped Hare, 156, 158
Blyth's Horseshoe Bat, 216
Brush-tailed Porcupine, 156, 158
Five-striped Palm Squirrel, 195, 231
Golden Jackals, 94, 130, 156–157, 216
Indian Fruit Bat (Flying Fox), 157, 216
mongoose, 130, 132, 142, 157, 204
Nilgai, 156, 158
Rhesus Macaque, 156, 208
Mary, Queen, 12, 28
maulsari, 76
moths, 140–142, 216
Cucumber, 140–141
Geometridae, 142
Tussock, 140–141
camouflage techniques, 151
Mountbatten, Lord, 24
Mughal Garden, 18, 30, 37, 39, 41–47, 61, 76, 112, 122, 147, 163, 197, 216, 222
Mukherjee, Pranab, 26, 63, 117
Mustoe, William, 15, 17–18, 60–61, 68, 72, 89, 93
Notes Upon Roadside Arboriculture, 71–72

N

Narayanan, K.R., 26, 122
Narayanan, Usha, 122
Nehru, Jawaharlal, 24

P

Parker, R.N., 92
Patil, Pratibha Devisingh, 26, 122
phulai, 97
pilkhan, 21, 42, 69, 71, 82–83, 138, 164, 191,198, 216, 222, 224
pollination, 144–145
Prasad, Rajendra, 24
Pusa Agricultural Research Institute, 121
putranjiva, 44, 69, 73–75, 81, 126, 191, 196

R

Raisina (Hill, village), 12, 14, 17, 29, 91
Rajagopalachari, C., 24, 26
Reddy, Neelam Sanjeeva, 122
reptiles and amphibians, 152–155, 233
Brahminy Worm Snake, 153
Brook's Gecko, 232
Common Wolf Snake, 233
Indian Marbled Toad, 153, 155, 211
Lizard, Oriental Garden, 143,153–154, 204
Ornate narrow-mouthed frog, 153, 155, 211
Ratsnake, 152–153, 208, 232
Spotted Supple Skink, 153
Striped Keelback, 208, 211
Ridge or *pahaadi,* 14, 90–91, 97, 126 (*see also* Central Ridge)
roses, 18–19, 44, 48–53

S

sausage tree, 88, 231
seasons
autumn, 212–216
monsoon, 200–211
spring, 222–229
summer, 230–233
winter, 218–221
sewage treatment plant, 26
Shah Jahan, Emperor, 34
shisham, 92, 99,100, 198, 214
Singh, Zail, 122
sita ashok, 99
solar lighting, 26
son khair, 95, 129
spiders, 148–151, 204
ant-mimicking, 151
camouflage techniques, 151
Cellar, 151
Cobweb, 150
Funnel-web, 150
Garden, 150

Jumping, 151
Lynx, 150–151
Mesh-weaver, 150
Orb-web, 150
Tree-trunk or two-tailed, 151
Wandering, 151
Wolf, 151
Spiritual Garden, 26–27, 95, 129, 203, 214
Swinton, George, 17

T

Taj Mahal, 34, 39, 60
Talkatora Bagh, 18, 89
Trees,
avenue trees, 68-89
indigenous trees, 14–15, 90-94, 98, 126-129, 130, 159
goolar, 126, 138, 157, 214, 216
jackfruit, 118, 206
kachnar, 196, 226
karanj, 72–73, 164, 188, 193,198, 208, 228
khirni, 69, 71, 77, 98, 196, 198, 228
kosam, 86–87, 126
laurel fig, 19, 69, 79–80, 138, 196
pilkhan, 21, 42, 69, 71, 82–83, 138, 164, 191,198, 216, 222, 224
putranjiva, 44, 69, 73–75, 81, 126, 191, 196
shisham, 92, 99,100, 198, 214
subabool, 126, 159, 196, 198
trumpet vine, 55
tulips, 45–47, 61, 112, 122

V

vajradanti, 130
vegetables (Dalikhana), 117, 119
Venkataraman, R., 122
vermicomposting, 26, 111
vilaiti keekar, 14, 15, 93-94, 95, 126, 129, 159, 218, 220, 222, 228
Villiers-Stuart, Constance, 32–33, 38–39
Gardens of the Great Mughals, 38
visitors, 65, 109, 112, 114, 117

W

Wasps, 204, 207, 212
Wellesley Road (now Zakir Hussain Marg), 82
wild almond, 104
Willingdon, Lady, 28
Willingdon, Lord, 93
Wilson, E.O., 132





FRONT COVER. The Rashtrapati Bhavan and Mughal Garden reflected in a drop of water [Conceived by Narendra Bisht]

BACK COVER. Lime Butterfly on a rosy periwinkle blossom



PUBLICATIONS DIVISION
MINISTRY OF INFORMATION AND BROADCASTING
GOVERNMENT OF INDIA